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Reinforced Concrete Bridges Stand Every Test

Williams Bridge—Columbus, Ohio.

D. W. McGrath, Contractor, Columbus, O.

Walter Braun, County Engineer, Franklin County.

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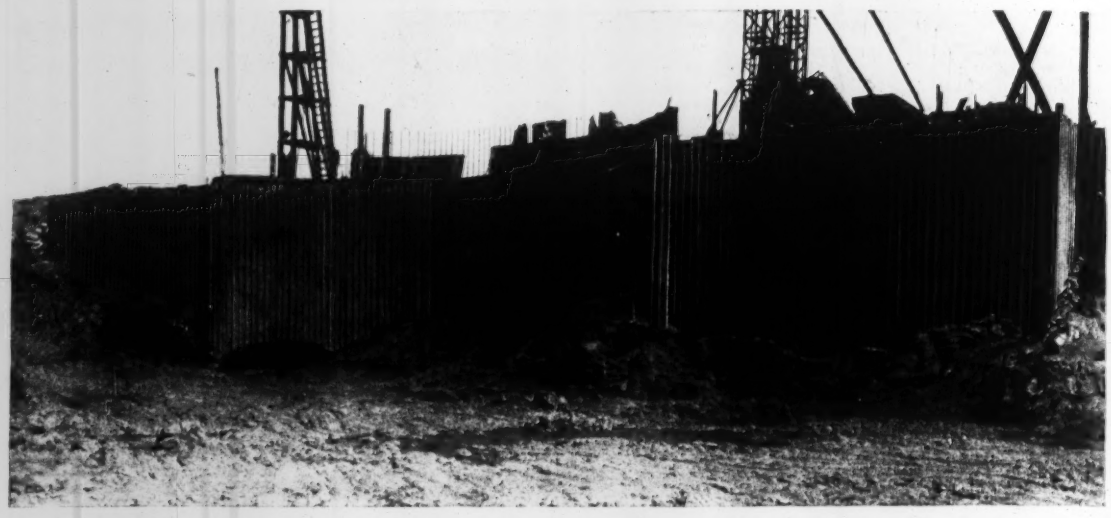

Partially Completed Breast Wall and the Lackawanna Steel Sheet Piling Cofferdam in Which It Was Built, Lock No. 2. Welland Ship Canal.

The pictures show the wall after the excavation had been made in front, and just before and after the Lackawanna Steel Sheet Piling at this location had been pulled. This is perhaps the first time that a cofferdam of such magnitude and depth has been so exposed.

The material excavated from the lock area of the lower level (on the down stream side) was removed by a drag line, and after this excavation was completed the steel sheet piling (45-foot lengths) was drawn with a 50-ton 5-sheave block and tackle suspended from timber A-frame standing on top of the wall and operated by a steam hoist.

The steel sheet piling on the sides of this wall were left in place as permanent protection, but that removed from the front as indicated in the lower picture was reused in similar work on Lock No. 3. In the latter instance, however, building paper placed between the concrete and that sheet piling which was to be removed, greatly facilitated the pulling operation.

The cofferdam work on both locks was under the personal direction of Messrs. Hutchinson, Phillips and Andrus of Baldry, Yerbaugh & Hutchinson, Ltd., St. Catherines, Ont., and like all other proper applications of Lackawanna Steel Sheet Piling served its purpose with entire satisfaction. Note particularly in the upper picture the regularity to which the sheet piling drove. In view of the fact that this steel sheeting was driven its entire length of 45 feet and that the lower 7 feet penetrated hardpan, the plumbness and uniformity of tops bear good testimony to the serviceability of the Lackawanna type of steel sheet piling.

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Engineering News

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Pitt River Reinforced-Concrete Arch in California

The view on this page shows the recently completed reinforced-concrete arch bridge across the Pitt River, near Baird, Calif., about 50 mi. south of Mt. Shasta, the falsework erection of which was described in *Engineering News*, Jan. 13, 1916, p. 50. The bridge forms a link on the new California State Highway that is to extend for 800 mi. up and down the state. As shown in the view and in the drawings, it is composed of a single-arch span approached by earth-fills and girder spans curving into the straight line of the bridge on either side. The main span is made up of two arch ribs, 242-ft. clear span and 38-ft. clear rise, carrying a 21-ft. roadway. This roadway is on a reinforced-concrete floor slab which is in turn carried on longitudinal and transverse stringers, the former being supported by the spandrel columns of the bridge.

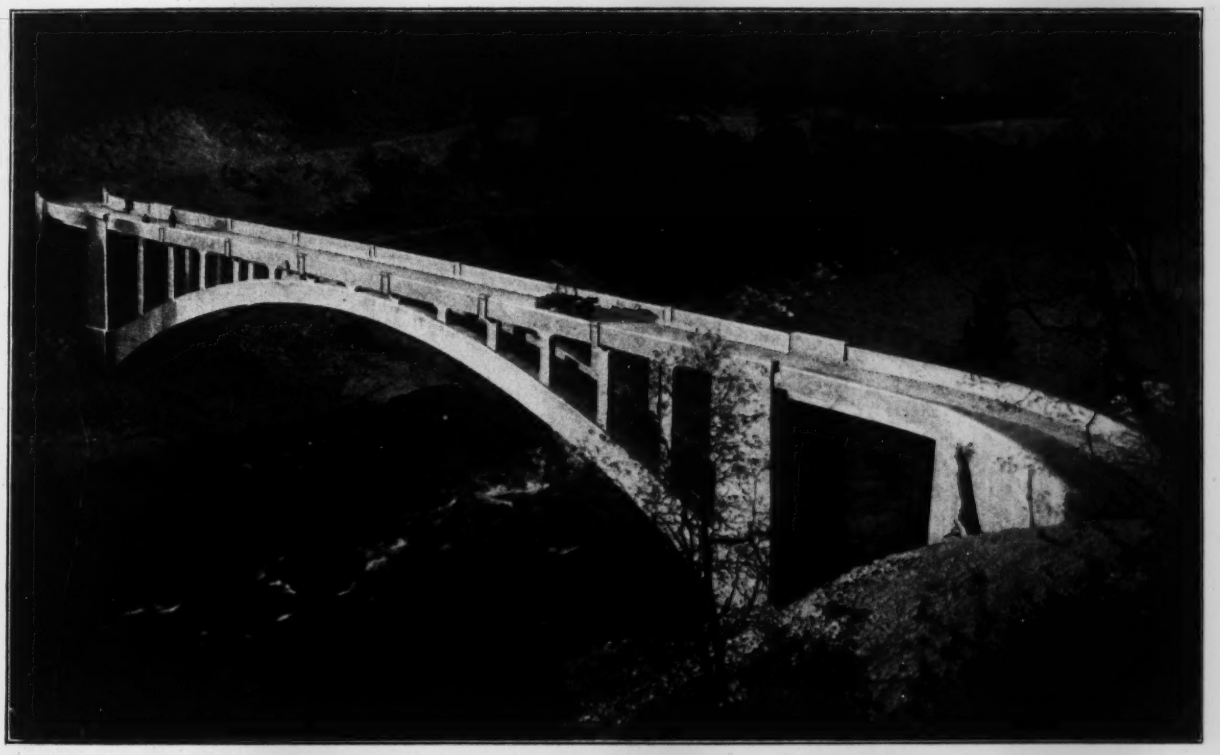


FIG. 1. NEW CONCRETE BRIDGE ACROSS PITT RIVER ON CALIFORNIA STATE HIGHWAY

The arch ribs are reinforced in three planes with two sets of rods tied together with closely spaced stirrups and are cross-braced with a Warren truss system of bracing placed after the ribs were completed. To do this recesses were left in the arch ribs with rods protruding and the heavily reinforced Warren bracing was cast into the recesses and around the rods. An interesting feature of the column design is the elliptical return from column to stringer, instead of the circular curve generally employed there.

The reinforcement of the bridge was designed to be round rods tied together with turnbuckles, but such rods were unobtainable at the time the bridge was built so that the design was changed to square corrugated rods tied together with Crosby clips.

The somewhat complicated approaches, as shown in Fig. 3, consist of an earth-fill section nearest the shore and a girder-span approach. This approach upon each side was composed of four reinforced-concrete girders carrying a slab floor, the inner of the girders being somewhat curved, but the other three being straight and the curve on the plan of floor being taken up by the overhang of the outside and inside girder. The earth-fill section is composed of comparatively thin reinforced-concrete walls on the outside, with a longitudinal girder approximately centered between the two curves, supported

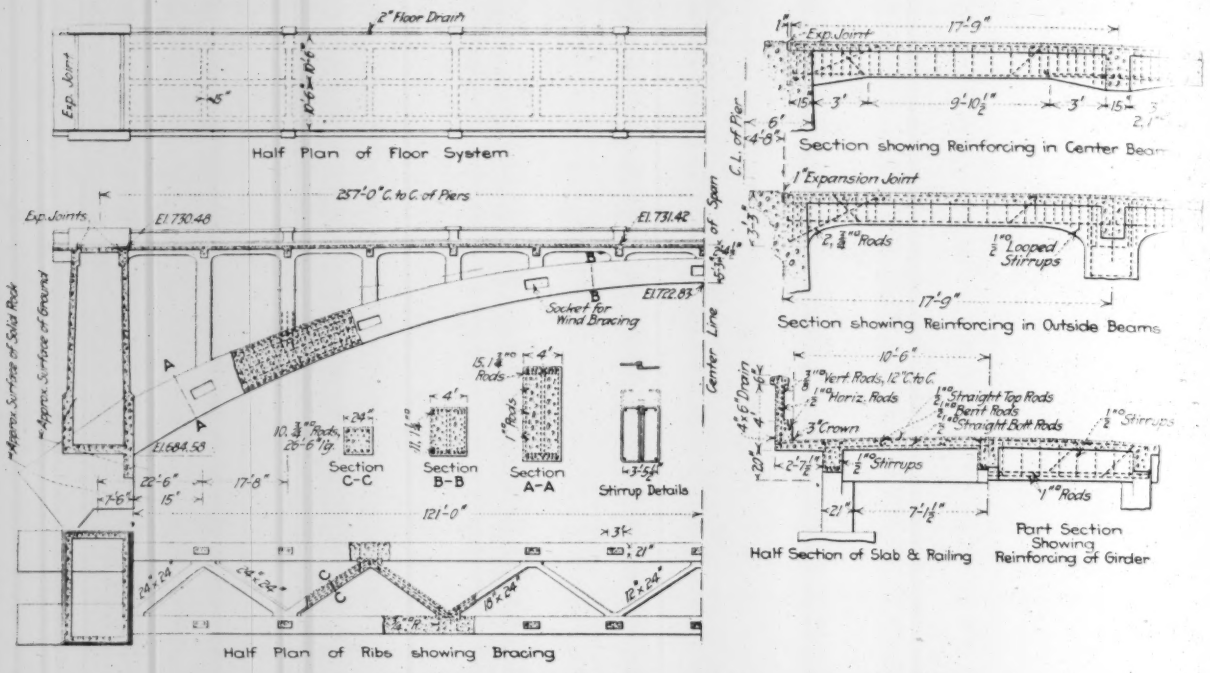

Half Plan of Floor System
Section showing Reinforcing in Center Beam
Section showing Reinforcing in Outside Beams
Half Section of Slab & Railing
Part Section Showing Reinforcing of Girder
Half Plan of Ribs showing Bracing
Stirrup Details

FIG. 2. GENERAL DETAILS OF MAIN SPAN OF PITT RIVER BRIDGE

at the middle of its length on a reinforced-concrete column. The railings throughout were solid.

The live-loads used for the arch ribs were a 20-ton traction engine for the floor system and a load of 20 tons distributed over 8x15 ft., together with a uniform load of 80 lb. per sq.ft. on the remaining floor area. All loads were placed to produce maximum stress. Temperature stresses were computed for a range of 30° F. either way from the normal, this being about the annual variation of mean daily temperature for this region.

The maximum stresses in pounds per square inch permitted were 16,000 for steel; 650 for concrete in beams; 600 for concrete in arch ribs under dead- and live-loads, and 750 for concrete in arch ribs under the maximum combination of dead, live and temperature stresses. It was considered that the maximum combined stresses will

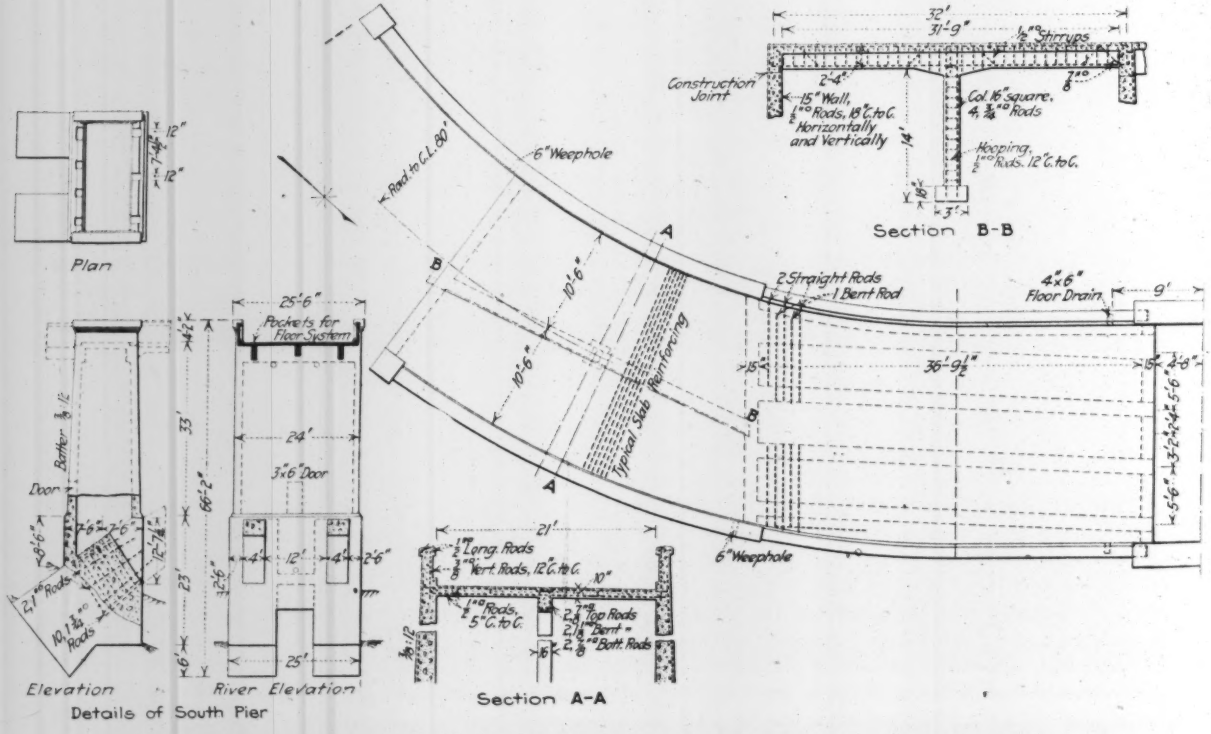


FIG. 3. APPROACH DETAILS OF PITT RIVER BRIDGE ON CALIFORNIA STATE HIGHWAY

occur very infrequently. Influence lines for the stresses at the crown were computed and both dead- and live-load stresses derived from the influence lines. All computations, however, were carried out analytically, graphic work being used only in checking portions of the work. The amount of steel used in the arch ribs was very arbitrarily determined, being much greater than is required by the small tension existing under some combinations of loading. The amount used is that which in the judgment of the designer will insure that the ribs will have the toughness characteristic of thoroughly reinforced concrete members.

The bridge is the longest concrete span in California. It was designed in the office of the State Highway Commission under the direction of A. B. Fletcher, Highway Engineer. The contract was carried out by the Ross Construction Co., of Sacramento, Calif., with George G. Pollock as Chief Engineer in charge of the work.

Large Taintor Gates for a Dam

The 1,000-ft. concrete dam of the Wisconsin River Power Co. at Prairie du Sac, Wis. (described in *Engineering News*, June 8, 1916), has its crest formed by a series of large steel rocking gates of the Taintor type. They are 20 ft. wide and 14 ft. high, with a radius of 16 ft. 4 in. The gates are placed between piers which carry an operating platform, or bridge, having a track for the gate hoists.

The construction of these gates is shown in the accompanying drawing. Each gate has a center girder and two side girders, to the curved faces of which are attached horizontal 8-in. I-beams and channels. Upon this framing are the $\frac{5}{16}$-in. skin plates, which are riveted to the horizontal members. The horizontal joints are not lapped, as in the usual construction, but are welded, so that the skin is really a single sheet.

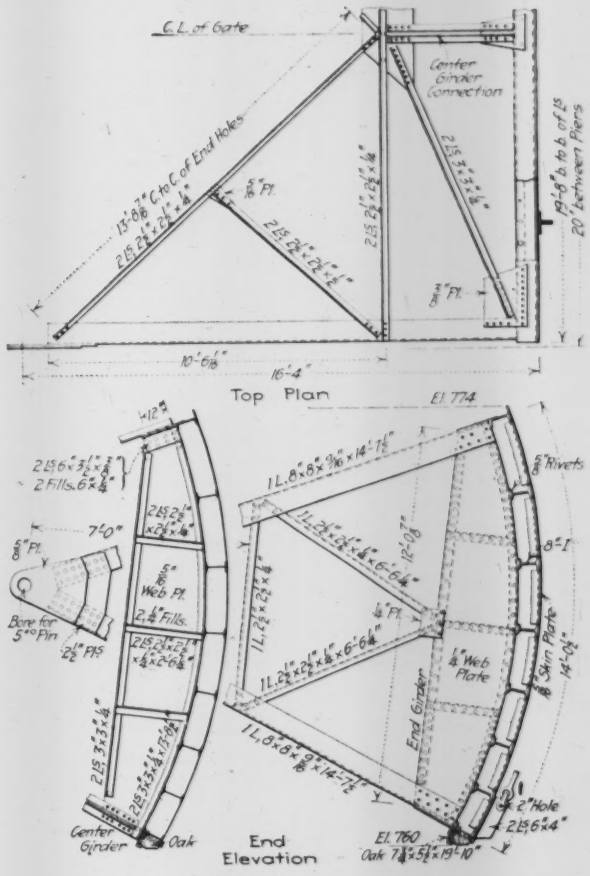
At each end of the gate is a triangular radius frame with 8-in. channels for the main members and bracing of angles 2½x2½ in. The apex of the frame is composed of a pair of ⅝-in. plates bored for a 5-in. pin. Diagonal struts extend from the apex of each frame to the center girder. The weight of each gate is about 7 tons.

The bottom of the gate has an oak closing timber 7¾x 5½ in. When the gate is lowered, this rests on the edge of a steel plate set vertically in the crest of the dam and projecting slightly above it. The plate is riveted between two angles, which are flush with the concrete. At the sides are rubber diaphragms to seal the spaces between the face of the gate and the piers. At two points along the bottom of the face are angle irons with pins and clevises for the attachment of the ⅞-in. operating chains.

The face of each gate was welded up complete at the shops and riveted to the frame consisting of the horizontal members and the three girders. There the material was painted. At the storage yard at the west end of the dam, the gates were assembled and riveted up, except for the bracing. A derrick picked up the gate and set it on its face on one of the electrically operated cars, which took it out upon a trestle at the downstream side of the dam. Here a pile-driver barge with derrick took the gate and placed it upon a scow which (with four or five gates) was floated into place.

With the scow moored at the piers of one gate opening, the gate was hauled up inclined skids to the top of the dam, and a floating derrick on the upstream side then set it in position, while the trunnion pins were placed. The interior bracing was then riveted up.

When the gates are in the normal lowered position, or are partly raised, the upper ends of the operating



LARGE TAINTOR GATES FOR DAM CREST AT PRAIRIE DU SAC

chains are attached to a toggle supported on the operating platform. For handling the gates there are two electrically operated hoists traveling upon the concrete platform, each hoist handling a gate independently of the other hoist.

The gates were designed by D. W. Mead and C. V. Seastone, of Madison, Wis., chief engineers for the power company. They were built by the Lakeside Bridge and Steel Co., of North Milwaukee, Wis., and erected by James O. Heyworth, of Chicago, the general contractor for the dam and power house.

Application of Bituminous Material to the surface of 100 mi. of waterbound macadam and chert gravel roads is to be undertaken by the State Highway Department of Tennessee, in the Counties of Shelby, Madison, Knox, Hamilton and Davidson. The department is applying the funds collected from the automobile tax to the purchase of bituminous materials for application to waterbound roads that are rapidly deteriorating under motor-car travel. The county authorities have already purchased motor-driven tank wagons for applying the bituminous material under pressure. Specifications for the work have been prepared by the State Highway Department in coöperation with the enginering departments of Vanderbilt University and the University of Tennessee.

An Economical Water-Supply from Flowing Wells

For a city upwards of 30,000 population, Ogden, Utah, has probably developed a new water-supply at as low a cost as any city on record. For many years the water-supply came from the Ogden River, where the city had to contend with the rights of other water users, as well as with a water-supply constantly in danger of contamination.

The water-shortage problem has been solved by drilling 23 artesian wells in Ogden Cañon, about 7 mi. from the city. The wells are grouped as shown in Fig. 3. Their size varies from 2 to 6 in. in diameter, the more recent ones being 6-in. In depth the wells range from 113 to 204 ft. The pressure of the water at the surface of the ground is about 6 lb. per sq.in., and at the point of delivery into the intake from 2½ to 3 lb. The water is of excellent quality and its temperature the year round is about 46° F.

The wells were all drilled by city labor with a municipally owned well-drilling machine. The cost was about $12,000, including in that the cost of the machine.

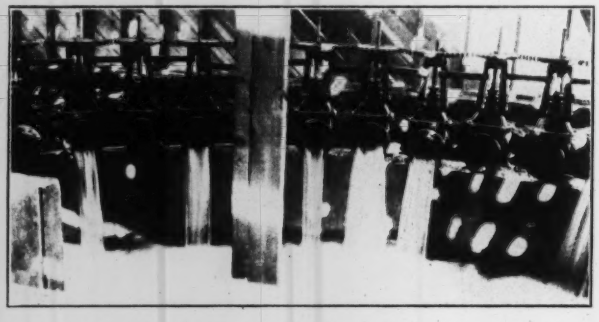


FIG. 1. PART OF THE OGDEN WELLS DISCHARGING INTO COLLECTING BASIN

The 73.4 acres of land surrounding the wells cost $11,410 and the intake (Fig. 2) cost about $10,000. The 5.33 mi. of new pipe line required (36-in. redwood 2.1 mi., and 24-in. Matheson-joint steel pipe, 3.2 mi.) cost $112,300, making the entire cost of the new water-supply about $145,710. The flow from the wells in May, 1916, was about 6,200,000 gal. daily.

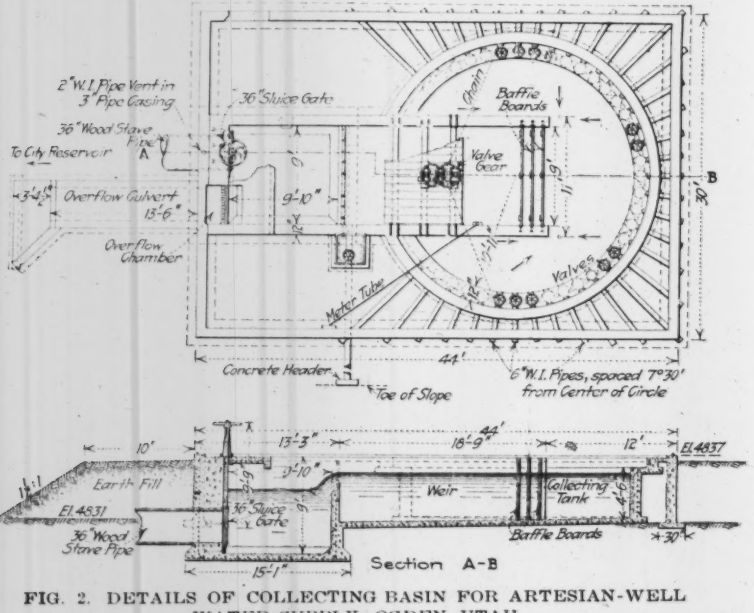


FIG. 2. DETAILS OF COLLECTING BASIN FOR ARTESIAN-WELL WATER-SUPPLY; OGDEN, UTAH

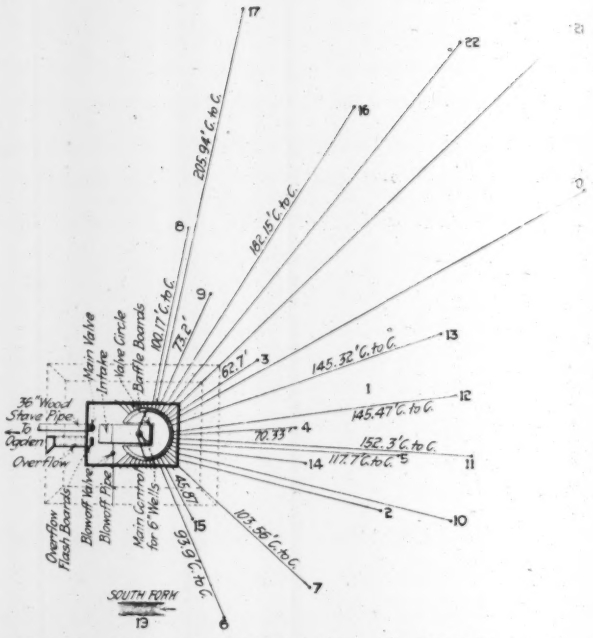


FIG. 3. PLAN OF TWENTY-TWO ARTESIAN WELLS; OGDEN, UTAH, WATER-SUPPLY

Fig. 3 shows the arrangement of 22 of the wells, numbered in the order in which they were drilled. No. 19 was abandoned at about 100 ft. of depth on account of the loss of the drills. The new wells are considerably deeper than the first ones. Fig. 2 gives the details of the collecting works, and the inlet of the new 36-in. pipe to the city. The gates of the well inlets were designed to be operated simultaneously by a chain and sprocket, but this feature was subsequently found unsatisfactory and was abandoned. The collecting basin is covered by a wooden house. The engineers in charge were aware of the possibility of obtaining more water by lowering the well outlet pipes, and so recommended. The design shown was a concession to a city executive who wished to have the flowing of the wells capable of ocular demonstration. The water from the collecting basin flows by gravity to two high concrete-lined distributing reservoirs near the city, which have a combined capacity of 21,000,000 gal.

The new water-supply of Ogden was developed under the administration of Washington Jenks as City Engineer. Joseph M. Tracy was the engineer in direct charge of the water-supply and is now City Engineer.

Dry Farming and Irrigation in New Zealand are receiving increasing attention. There are large areas where the rainfall is scant and farming by the ancient method is not profitable. The soil is fertile if moisture can be secured, and it is claimed that there are many satisfactory sites for irrigation plants.

Proper Methods of Testing Water-Works Pumps

By L. A. Day*

SYNOPSIS—Argument is made for adhering to the testing Code of the American Society of Mechanical Engineers. Where irregular specifications are the basis of commercial bids, still enough data should be secured to enable the Code data to be presented. The confusion from irregular reports is illustrated by studies of the figures from a Montreal test.

Since reading the recent discussions in *Engineering News*, relating to the acceptance test on the Montreal turbine-driven centrifugal pump, it has occurred to me that perhaps the generally accepted method of executing and reporting such tests is not known and understood as well as it should be, so that a discussion would be welcome to water-works men.

There are a number of possible ways of conducting and reporting the results of such tests. In order to avoid confusion and misunderstanding the American Society of Mechanical Engineers has published a code for testing this class of machinery, which may be found in Vol. 34 of the "Journal" of the society. This Code is generally accepted and adhered to by all engineers, and it is to be urgently recommended that all published data and results should be entirely in accordance with the standards established in the Code.

Irregular Specifications

It frequently happens, however, that specifications are so worded that it is impossible in the official results to conform strictly to the Am. Soc. M. E. Code throughout. However, there is nothing to prevent including sufficient data in the published results to enable an engineer to reduce these results to the standard set forth in the Code.

For instance, in cases where the discharge opening is smaller than the inlet on the pump and there is a higher velocity through the discharge than through the inlet the work actually done by the pump is greater than that based on the head indicated by a pressure gage at the center line of the discharge pipe. This is due to the fact that a certain amount of work is performed in accelerating the water in the pump itself, which means that in addition to the necessary head to deliver the water against the discharge pressure a velocity head must be produced which is given by the familiar formula

$$h = \frac{V_2^2 - V_1^2}{2g}$$

where

V_2 = Velocity through the discharge, feet per sec.;
V_1 = Velocity through the inlet, feet per sec.;
g = 32.16.

The Code specifies that this increase in velocity head should be added to the head indicated by the discharge gage in computing the net head. When specifications forbid such an allowance, the area at the inlet and discharge flanges on the pump should be included in the published data, thus making it possible to correct the head computed according to specifications and make it conform with the Code.

Again, it is customary to measure the suction lift or head at the center line of the inlet pipe directly before the inlet flange, and the discharge head at the center line of the discharge pipe directly after the discharge flange. The net head is the discharge head, plus the velocity head, plus the vertical distance between the centers of the two gages, plus the suction lift, or minus the suction head. When other locations of these gages are specified, it is entirely possible to measure the heads at the places stated and to include the results in the published data.

When the results of a test show that a pump really has exceeded all previous records for pumps of its class, it is especially desirable to publish, with the results, complete information so that all manufacturers can satisfy themselves as to the accuracy of computations and correctness of methods used. A good example of the confusion that may grow out of failure to publish data enabling results to be reduced to a comparative basis is shown by the duty test of the Montreal pump, published in *Engineering News*, Apr. 27, 1916, including the comment on page 810.

At the outset the article descriptive of the test claims outright a duty of 168.3 million foot-pounds per 1,000 lb. of steam, and farther on makes this remarkably high duty (for a machine of this capacity) still more remarkable by giving the pump no credit for friction head in the suction pipe, condenser and discharge pipe up to the city mains. The article further stipulates that no allowance was to be made for velocity head produced in the pump and also states that the pump would be charged up with the steam used to drive auxiliary apparatus necessary for the operation of the unit, but that the pump would be given credit for all heat recovered from the exhaust.

Tests According to Code

The Am. Soc. M. E. Code recognizes but two methods of manipulating and reporting a duty test: (1) The determination of the work done per 1,000 lb. of steam expressed in million foot-pounds; (2) the determination of the work done per million B.t.u. expressed in million foot-pounds. It is useful to consider separately the points mentioned in the report of the foregoing test in their relation to the Code.

First, in regard to friction in the suction pipe, condenser and discharge pipe it may be said that from the data given no adequate idea of the amount of this friction can be gathered, except that it formed about 6.3 million foot-pounds of the total work per 1,000 lb. of steam, or 3.75%. This may or may not be excessive, depending on the layout and arrangement of the piping and unit.

*Chief Mechanical Engineer, Water Division, Department of Public Utilities, St. Louis.

Second, if the entrance and exit to the pump are of the same area, there is no allowance to be made for increase in velocity head, since there can be no increase in velocity. Furthermore, if the discharge pipe is smaller than the suction pipe, there will be an increase in velocity; but if the discharge pipe flares out after leaving the pump and is properly designed, this velocity head will be reconverted into pressure head, and with the discharge gage placed beyond the flare, the pump is not entitled to an allowance for velocity head.

Third, the duty per 1,000 lb. of dry steam should mean just what it says—namely, the total work divided by the total dry steam and the quotient multiplied by 1,000. No credit is to be given the pump for any feed-water heaters in the exhaust or for any heat otherwise recovered. It is for this reason that this method of stating the duty is objectionable; however, if used, it should be strictly adhered to, and complete data in regard to auxiliaries, heaters, vacuum and feed-water temperature should be given if it is desired to include any further deduction than those stated.

The Code says, "The duty per million B.t.u. is found by dividing the total number of foot-pounds of work done by the total heat consumed in B.t.u. and multiplying the quotient by 1,000,000." This is a strictly commonsense method of expressing the performance of steam-driven machinery. The one difficulty lies in the fact that some specifications require the steam used by auxiliaries to be included in the steam consumption of the pump and some do not. According to the Code, the steam used by auxiliaries should be charged against the pump and due credit given the pump for heat returned to the condensate from the exhaust of the auxiliaries. This necessitates the measurement of the steam consumption by the auxiliary apparatus, which is not always an easy matter since this apparatus is run noncondensing. Perhaps the best method is to arrange an atmospheric condenser that will be large enough to condense all the auxiliary steam, so that it can be weighed. After determining the steam consumption of the auxiliaries at various capacities of the pump, the exhaust steam from the auxiliaries can be turned into the heaters and the duty test run weighing the condensate from the pump only.

Let

Q_1 = Heat of the liquid in the steam at the throttle;
X_1 = Quality of the steam;
L_1 = Latent heat in this steam;
Q_2 = Heat of the liquid in the condensate leaving heaters supplied by steam from unit;
S = Total net water consumption (for pump and auxiliaries).

The total heat consumed by the engine then is, for saturated steam,

$$H_t = S(Q_1 + X_1 L_1 - Q_2)$$

Total heat consumed for superheated steam is

$$H_t = S(H_1 - Q_2)$$

where

H_1 = Total heat per pound of steam as supplied;
Q_2 = Heat of the liquid of the condensate leaving heaters supplied by steam from unit;
S = Total net water consumption.

The Am. Soc. M. E. Code recommends a complete scheme for keeping data during tests, on pages 1761 to 1763, Vol. 34, of the "Journal" of the society.

With these fundamental principles clearly in mind, it is often possible to analyze the results of a test, even though the published data are incomplete, and determine whether the claims made are reasonable.

For instance, in the editorial comment on page 810 of *Engineering News*, Apr. 27, 1916, the statement is made that the Montreal pump showed a duty of 168.3 million foot-pounds per million B.t.u. This can only mean that, from the total heat supplied to the turbine and auxiliaries the heat recovered by feed-water heaters was subtracted, and the total work done was divided by this difference, the result multiplied by 1,000,000 being 168,300,000 ft.-lb. This result taken in conjunction with the other test data looks impossible. Due to the lack of complete data it is necessary to make certain assumptions that will favor the pump.

Let X = net B.t.u. absorbed by the turbine per pound of steam supplied; since 1,308,808 Imperial gallons were pumped, the weight per gallon was 10 lb., the net head was 205.874 ft. and the total steam was 16,638 lb., it follows that if the duty per million B.t.u. is 168,300,000 ft.-lb., then

$$\frac{1{,}308{,}808 \times 10 \times 205.874}{X \times 16{,}638} \times 1{,}000{,}000 = 168{,}300{,}000$$

Solving for X gives 962 B.t.u. But the total heat at 140 lb. gage and 100° superheat is 1,250 B.t.u. Hence the heat per pound available for heating feed water is only $1{,}250 - 962 = 288$ B.t.u. Furthermore, this heat must be imparted to the feed water as heat in the liquid. Now in order to obtain a heat in the liquid of 288 B.t.u. per lb. the feed water would have to be under a pressure of at least 87.7 absolute and have the high temperature of 318°.

This looks interesting, but the question at once arises as to how the intermediate heaters were arranged to cause the heat to flow into the feed water at this temparature. It would seem to necessitate that before the steam had been expanded down to 73 lb. gage some of it at least would have to be bled off to the heaters. When it is remembered that the initial pressure is only 140 lb. gage, it is hard to believe that this would produce economical results.

The writer would also point out that in the original report of the Montreal test no mention was made of any intermediate heaters, the impression being given that exhaust steam from the auxiliaries only was used for heating feed water. With heaters supplied with exhaust from the auxiliaries only, it is fair to assume: (1) That the temperature of the condensate leaving the condenser was not greater than 125°, which corresponds to a vacuum of 26 in.; (2) that the auxiliaries did not consume more than 2,000 lb. of steam per hour; (3) that not more than 1,000 B.t.u. per pound of auxiliary exhaust was recovered in the heaters. With these assumptions we then have 1,250 B.t.u. as the total heat per pound of steam at 140 lb. gage and 100° superheat. The heat of liquid at 26-in. vacuum is 93 B.t.u. The heat consumed by the turbine per pound of steam is 1,157 B.t.u. The total heat consumed per hour by the turbine working under specified conditions is $16{,}638 \times 1{,}157 = 19{,}250{,}000$ B.t.u. The heat reclaimed in the feed-water heaters is $2{,}000 \times 1{,}000 = 2{,}000{,}000$ B.t.u. The total net heat consumed is 17,250,000 B.t.u. The net heat consumed per pound is 1,037 B.t.u.

The duty in million foot-pounds per million B.t.u. then becomes:

$$Duty = \frac{1{,}308{,}808 \times 10 \times 205.874}{1{,}037 \times 16{,}638} \times 1{,}000{,}000 = 156.2$$

This would appear to be the maximum obtainable duty under the liberal assumptions made.

It would be interesting to know how the auxiliary steam was measured in the test referred to and how the machine was manipulated to obtain the excellent duty claimed for it. It would also be of interest to many to know the allowances made in correcting for difference in superheat and pressure between the test conditions and those specified.

I would also like to point out a few apparent errors in computation in the published data on p. 801, *Engineering News*, Apr. 27, 1916. For instance, the rate per 24 hr. should be 31,411,392 gal. It is not practical to include more than the fifth significant figure; but if given, the result should be correct.

If the actual steam consumption per water horsepower is 12.7 lb., then the total actual water consumption of the turbine (uncorrected) is $12.7 \times 1{,}360.85 = 17{,}283$ lb. per hr.; but the test data state that the consumption corrected for credits is 17,344 lb. per hr.—that is, the corrected consumption is more than the actual, whereas it should be less. There is something about this that I do not understand.

The duty per 1,000 lb. of steam actually supplied is

$$\frac{1{,}308{,}808 \times 10 \times 205.874}{17{,}283} \times 1{,}000 = 155.9$$

This duty is given as 155,356. There is some inaccuracy here also.

If the steam consumption corrected for credits is 17,344 lb., as stated, then the correction for lack of superheat must have been unusually high, since a negative correction for 5 lb. excess pressure should also be applied. The net correction amounts to $\frac{17{,}344 - 16{,}638}{17{,}344} = 4.07\%$, or neglecting the excess pressure this is an allowance of 1% for $\frac{37}{4.07} = 9.09°$. My experience would indicate that an allowance of 1% for 12° superheat is more nearly correct for turbines. However, all turbines do not respond alike to superheat.

Since the actual steam consumption was 12.7 per hp.-hr. and the consumption corrected to contract conditions was $\frac{16{,}638}{1{,}360.85} = 12.2$ lb. per hr., the percentage of steam consumed by the auxiliaries and charged against the pump was

$$\frac{12.7 - 12.2}{12.7} = 3.94\%$$

or practically 4%.

The results claimed may be analyzed from another standpoint. Considering the location of the installation, the cooling water available must have been from 40° to 50° F. With a condenser of 3,000 sq.ft. cooling surface, a vacuum of 28.5 in. would have been easily maintained. It would be fair to assume a barometric pressure of 29.8 in. Then with steam at 159.7 lb. absolute, barometer 29.8 in., 63° superheat and a final vacuum of 28.5 in., or 0.638 lb. absolute, we have:

Initial heat in steam	H_1 =	1,231.50
Heat of liquid in final condition (assuming adiabatic expansion)	h_2 =	55.25
Entropy of steam in initial condition	N_1 =	1.6076
Entropy of liquid in final condition	n_2 =	0.1064
Final absolute temperature	T_2 =	546.88°

Total heat per pound available for useful work.

$U = (H_1 - h_2) - (N_1 - n_2)\, T_2$
$= (1{,}231.5 - 55.25) - (1.6076 - 0.1064)\, 546.88$
$= 1{,}176.25 - 820.98 = 355.27$

$$\text{Theoretical steam consumption} = \frac{2{,}546.6}{355.27} = 7.17 \text{ lb. per hp.-hr.}$$

Actual steam consumption per water horsepower-hour = 12.7
Allowing 4% steam for auxiliaries gives a steam consumption for the turbine alone of 12.2 lb. per hp.-hr.

$$\text{Overall efficiency} = \frac{7.17}{12.2} = 58.8\%$$

The guaranteed pump efficiency was 80% and covered pipe friction, condenser friction, velocity-head losses and in fact all hydraulic losses between the water in the suction well and the connection to the city main. We will make three assumptions of pump efficiency and compute the resulting turbine efficiency.

We then have the following:

	%	%	%
Pump efficiency asumed	80	82	84
Gear efficiency assumed	98	98	98
Combined gear and pump	78.4	80.4	82.3
Derived turbine efficiency	75.1	73.2	71.4

To my knowledge, for a turbine of this capacity an efficiency of 75.1% is impossible, an efficiency of 73.2% is highly improbable and my only acquaintance with an efficiency as high as 71.4% is the case of a Ljungstrum turbine, which I understand is not a commercially practical machine for this class of service. And in addition this claims an efficiency for the pump of 84%, which is very high to say the least, when it is remembered that it includes frictional loss in the suction, through the condenser and through the discharge pipe, up to the mains; also no allowance is made for increase in velocity in the pump.

If instead of assuming a vacuum of 28.5 in. with a 29.8-in. barometer, a vacuum of 29 in. be assumed, the absolute back pressure becomes 0.393 lb. absolute. Then:

Initial heat in steam	H_1 =	1,231.5 B.t.u
Final heat of liquid	h_2 =	42.32
$H_1 - h_2$	=	1,191.18
Initial entropy	N_1 =	1.6076
Final entropy	n_2 =	0.0788
$N_1 - n_2$	=	1.5288
Final absolute temperature	=	531.87°
Available heat	U =	378.06

$$\text{Theoretical steam consumption} = \frac{2{,}546.6}{378.06} = 6.73 \text{ lb. per hp.-hr.}$$

$$\text{Overall efficiency} = \frac{6.73}{12.2} = 55.2\%$$

	%	%	%
Pump efficiency	80	82	84
Gear efficiency	98	98	98
Pump and gear efficiency	78.4	80.4	82.3
Turbine efficiency	70.5	68.7	67.1

These turbine efficiencies are possible, but the pump efficiencies assumed are exceptional. If they really were obtained, the installation is excellent. However, I for one should very much like to see complete data.

Since making these computations and comparisons, I have seen the notes correcting the duty of the Montreal pump to 134,000,000 ft.-lb. per million B.t.u. and making mention of intermediate heaters. All these items only add to the confusion that surrounds this particular test. Therefore, new comparisons have not been made, as the ones given suffice to present the argument for more consistent reports on such machines. They are still satisfactory to show the procedure that may be followed in scrutinizing incomplete reports.

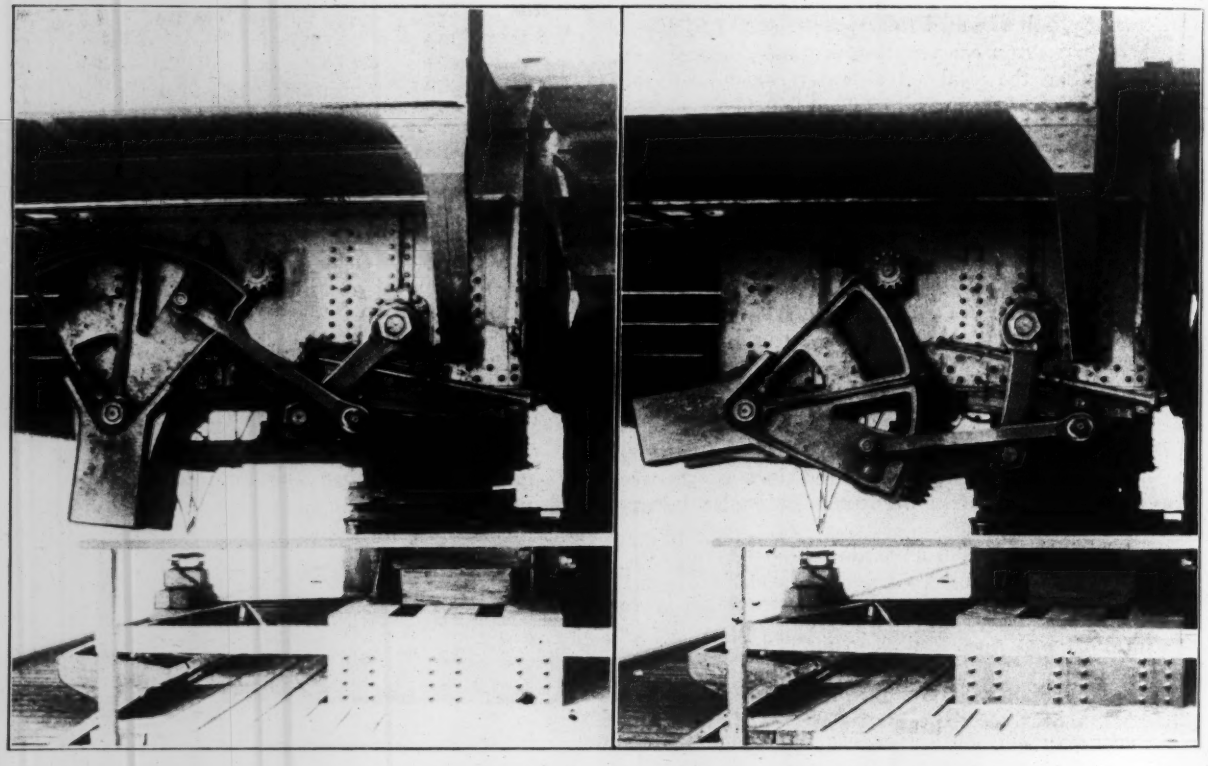
New Form of End Lift Used on Chelsea North Draw

By Randall D. Gardner*

A novel form of end lift is employed on the rim-bearing swingbridge built across the Mystic River on the road from Boston to Chelsea. The lift is made primarily by a toggle having a wheel or roller as bearing surface; but after this is driven, a flat bearing block is inserted to fit and thereafter the roller toggle is drawn back a trifle. Some other interesting features distinguish the bridge.

The draw is 363 ft. long by 60 ft. wide and spans two waterways of 125 ft. clear opening each. The trusses, of riveted type, are 44 ft. apart on centers, giving a roadway 40 ft. between curbs, which provides two car tracks and space for two lines of vehicles.

The draw weighs about 1,400 tons. Its weight is carried on 64 steel wheels running between steel-faced tracks.



FIGS. 1 AND 2. THE NOVEL END LIFT OF THE CHELSEA NORTH DRAW

The roller toggle acts first, the flat block on the single pitman arm is pushed home, and the roller is withdrawn slightly

Power for swinging is supplied by 28-hp. motors in parallel, one on each side, located on a floor inside the cross-girders on top of the drum. One motor will operate the draw in case of temporary disablement of the other, or the draw can be swung by man power in case current fails. An air-operated band friction brake is provided at the top of the rack-pinion shaft.

A centering device consisting of a bolt carrying a roller in the outer end, actuated by a 10-in. air cylinder, engages a Y-shaped casting on the landing. This device will center the draw when it is stopped within 12 in. of true position. Air for the centering device and air brakes is generated by a 5½x4¼-in. electrically driven Westinghouse air-brake pump located on the same floor as the turning motors.

The lifting device at either end is operated by an 8-hp. motor located under the deck of the bridge at that end. These motors are controlled by mechanical automatic devices geared direct to the motor, which limit the amount of the travel of the bearing block in either direction by operating a drum reversing switch.

The device for lifting comprises a double toggle joint that lifts the load on a roller bearing on the landing block and then inserts a flat block, as may be seen in Figs. 1 and 2, finally withdrawing the roller a trifle and transferring the load to the flat block. Fig. 1 shows the block wholly withdrawn and the bridge ready for swinging; Fig. 2 shows the block in final position, draw lifted. The lift is ¾ in. to 1 in. This takes out part of the dead-load deflection and, the trusses being continuous, is sufficient to offer stability under all loading. The load lifted varies from 50 tons to 80 tons per end.

The layout of the machinery completely avoids long shafts and flexible couplings. There are no shafts running up to the operating house, pipes and conduits being cheaper and more easily installed. Similarly, there are no shafts from center to ends of draw. The largest—the main or rack-pinion shaft—is 6¼ in. in diameter. The longest—the transverse shaft for the end lift—is 40 ft. long by 3½ in. in diameter.

The operating house is in the tower, some 34 ft. above the deck, over the middle of the bridge. This position gives the operator free view of both street traffic and navigation. The switchboard mounted in this room contains

*Assistant Engineer, Bridge and Ferry Division, Public Works Department, Boston, Mass.

FIG. 4. VIEW ALONG ROADWAY OF NEW CHELSEA NORTH DRAW

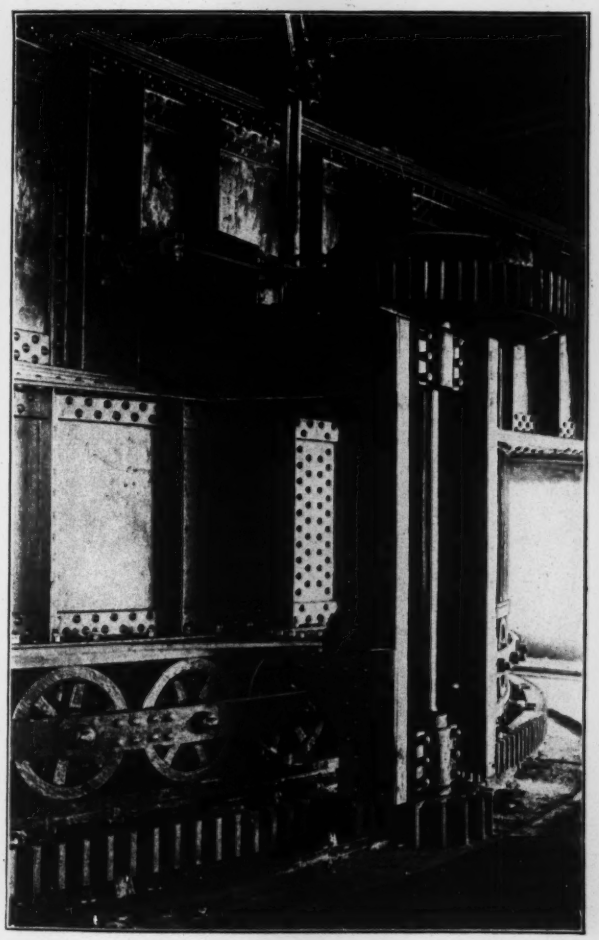


FIG. 3. RIM-BEARING ROLLERS AND TURNING BASIN

all the necessary switches, fuses, circuit-breakers, and meters for motors, lighting and heating, as well as the controllers, air valves, signal controls, etc.

The current for all motors is 550-volt direct current. Air pressure is 100 lb. The amount of current used for turning and lifting is as follows:

Turning		Random opening		End Lifting	
Time	Amperes		Time		Amperes
Start	60		Start out		15
15 sec.	50		5 sec.		12
30 sec.	45		10 sec.		10
45 sec.	45		12 sec.		8
60 sec.	45		Cutoff		
75 sec.	40				
80 sec.	40				
Off					

Closing			
Time	Amperes	Time	Amperes
Start	50	Start in	9
15 sec.	50	5 sec.	8
30 sec.	45	10 sec.	15
45 sec.	40	12 sec.	12
60 sec.	40	Cutoff	
75 sec.	35		
Off			

The air compressor uses 7 amperes for not over 2 min. per opening. The time for a complete opening is 4 to 5 min., if not delayed by the shipping.

The main line of the Bay State Street Ry. sends about 1,200 cars across this bridge every 24 hr. From the beginning of its service to date, during which time the draw has made more than 17,000 openings, there have been only trifling delays.

The floor of the bridge is of wood on steel framing. The steel stringers carry transverse 8x8 yellow-pine ties; these carry 4-in. yellow-pine plank laid longitudinally, and on the plank is the wooden pavement. This is of the Shuman "W. & A." type, consisting of wooden slabs about 6x2 ft., made of hard-maple strips 1x3⅞ coated with asphalt, laid on edge and tightly bolted together. The slabs are toenailed to the plank floor. The street-car rails rest on tie-plates laid directly on the 8x8 ties. The sidewalk surface is of 2-in. yellow-pine plank.

Four Engineering Innovations on the Magnolia Cutoff

By Francis Lee Stuart*

SYNOPSIS—(1) Rock slides prevented by triple benching. (2) Tunnel progress accelerated by use of steam shovel in heading. (3) Tunnel roof supported by steel segments. (4) Concrete retaining wall built by large steel traveler.

In building the Magnolia cutoff of the Baltimore & Ohio R.R., located at the eastern end of the Cumberland, Md., division, there were four unusual construction methods that, so far as known, have never been tried out to the same extent by any other railroad.

Benching Cuts to Prevent Slides

One of these unusual features is the so-called benching of the larger cuts, of which the most important is the thorough cut necessary to eliminate the old Doe Gully tunnel, coming within the section under contract by the H. S. Kerbaugh Co., Inc.

*Chief Engineer of the Baltimore & Ohio R.R.

This cut lies in what is geologically known as the Catskill formation and consists of sandstone and shale. When it was opened up, however, limestone in various quantities was found, although the predominating rocks proved to be the shales and sandstone. The strata dip in a very nearly easterly direction at an angle of about 10°, and it was decided to take out the north side of this cut in three benches, as the maximum vertical height on this slope was 196 ft. At the south side only two benches were found necessary.

These benches were decided upon as a means of lessening the pressure on the slopes and to prevent sudden large slides. They provide drainage for the slope, which is carried by this means to the end of the cut, and also constitute a horizontal surface intercepting the material, which slowly but continuously ravels and sloughs off from the slopes of such a large cut, because of the frequent changes in temperature and weather.

Transversely, the slope up to each bench is ½ : 1 on the southerly side of the cut and ¾ : 1 on the northerly

FIG. 1. DOE GULLY CUT ON THE BALTIMORE & OHIO R.R., SHOWING

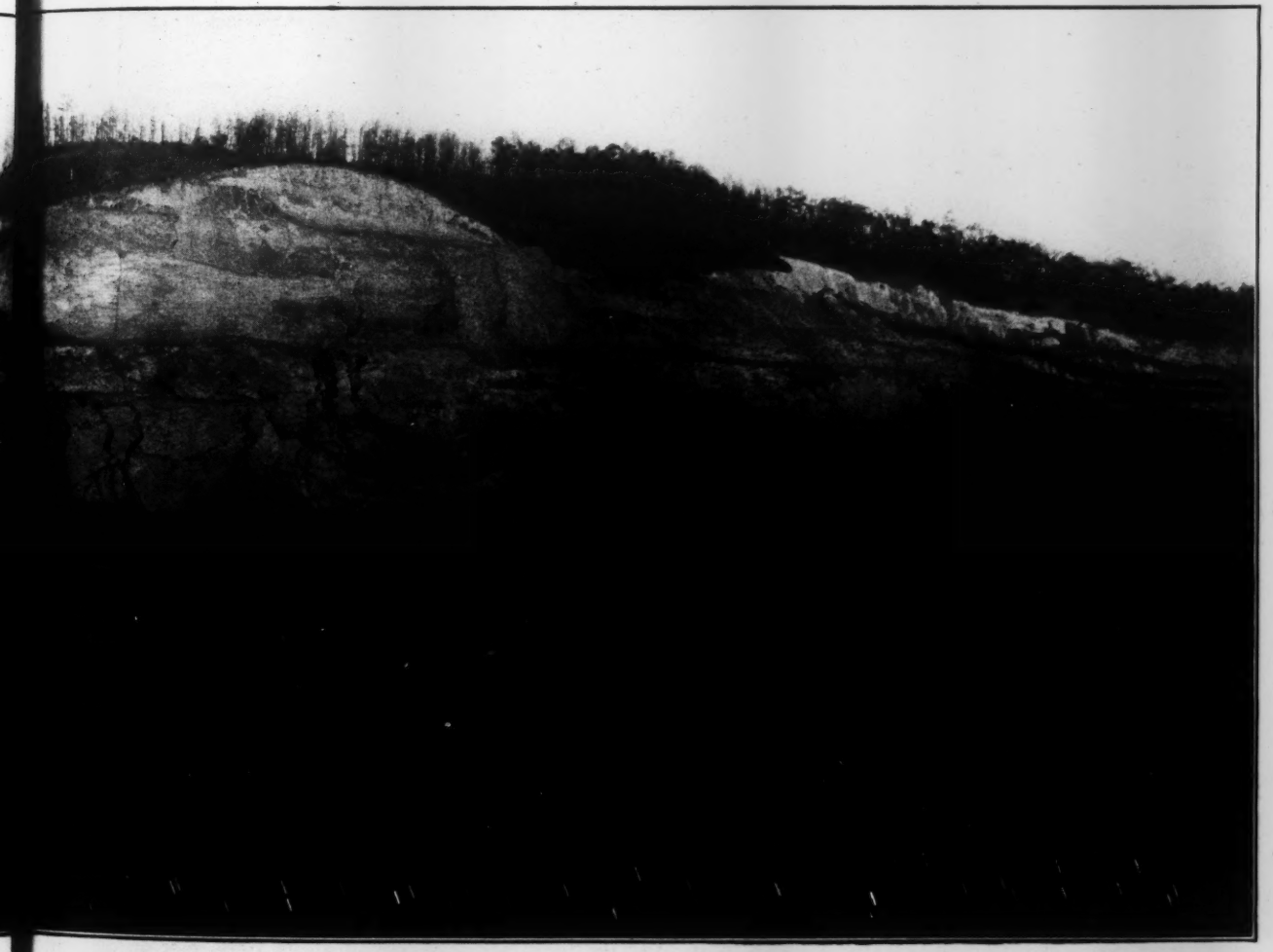
side, the latter being more exposed to the sun's rays and the effect of weathering. At the ends of the cut, benches were placed 25 ft. above subgrade; in the center they were 50, 100 and 150 ft. above subgrade. The lateral distance of the benches varied owing to the natural slope of the ground laterally, and the difference of heights between the ends and the center resulted in the lower bench having a lateral grade of 1½% descending in each direction toward the ends of the cut, the middle bench having a 2% grade and the upper bench a 3% grade. The surfaces of the benches were 20 ft. wide and slightly inclined toward the slope to carry the drainage to the ends of the cut without spilling any over the slopes between the benches.

At most of the other points on this improvement the height of cutting required the use of only a single bench of the same width and slope as those used at Doe Gully and with grades to conform to the length of the cut. We feel that we have succeeded in introducing a device that will save us a considerable amount in maintenance costs.

Steam Shovel in Heading of Stuart Tunnel

Stuart tunnel is 3,355 ft. long—the longest one on the improvement—and is one of the factors governing the time within which this improvement could be put into operation, and it was found necessary to employ all means to expedite the progress of its construction and to avoid any delay in opening the entire improvement. In order to accomplish the work as quickly as possible the idea was conceived of doing a portion of the widening of the heading with a small steam shovel. Accordingly, the contractor, H. S. Kerbaugh Co., Inc., installed a Marion 28 (⅝ yd.) air-operated shovel at the west portal. This shovel widened the heading and at the same time took out the bench to an elevation 6 ft. below the elevation of the wallplate. This method of handling the work was followed for a distance of 1,000 ft. eastward from the west portal, at which point the headings met.

A standard double-track tunnel section was used—31 ft. in the clear horizontally with sidewalls plumb to 11 ft. above subgrade and semicircular arch with 15½-ft. radius, giving a clear height of 22 ft. 11¼ in. at the center of each track. The average heading section was about 120 sq.ft. The dip of the strata varied from 30° to 50°, the strike being approximately parallel to the center line. A few overbreaks occurred, but no difficulty was found in operating the shovel. It effected a very considerable saving in time and expense, as it was possible to widen and place the steel segments at the rate of 60 to 70 lin.ft. of arch section per week, as compared to approximately 45 ft. by hand. In addition, the shovel removed a section of the bench 6x33 ft. or 7.33 cu.yd. per lin. ft., enabling the balance of the bench to be drilled without cat holes.



THE BENCHING OF ROCK CLIFFS TO PREVENT SLIDES ON TRACK

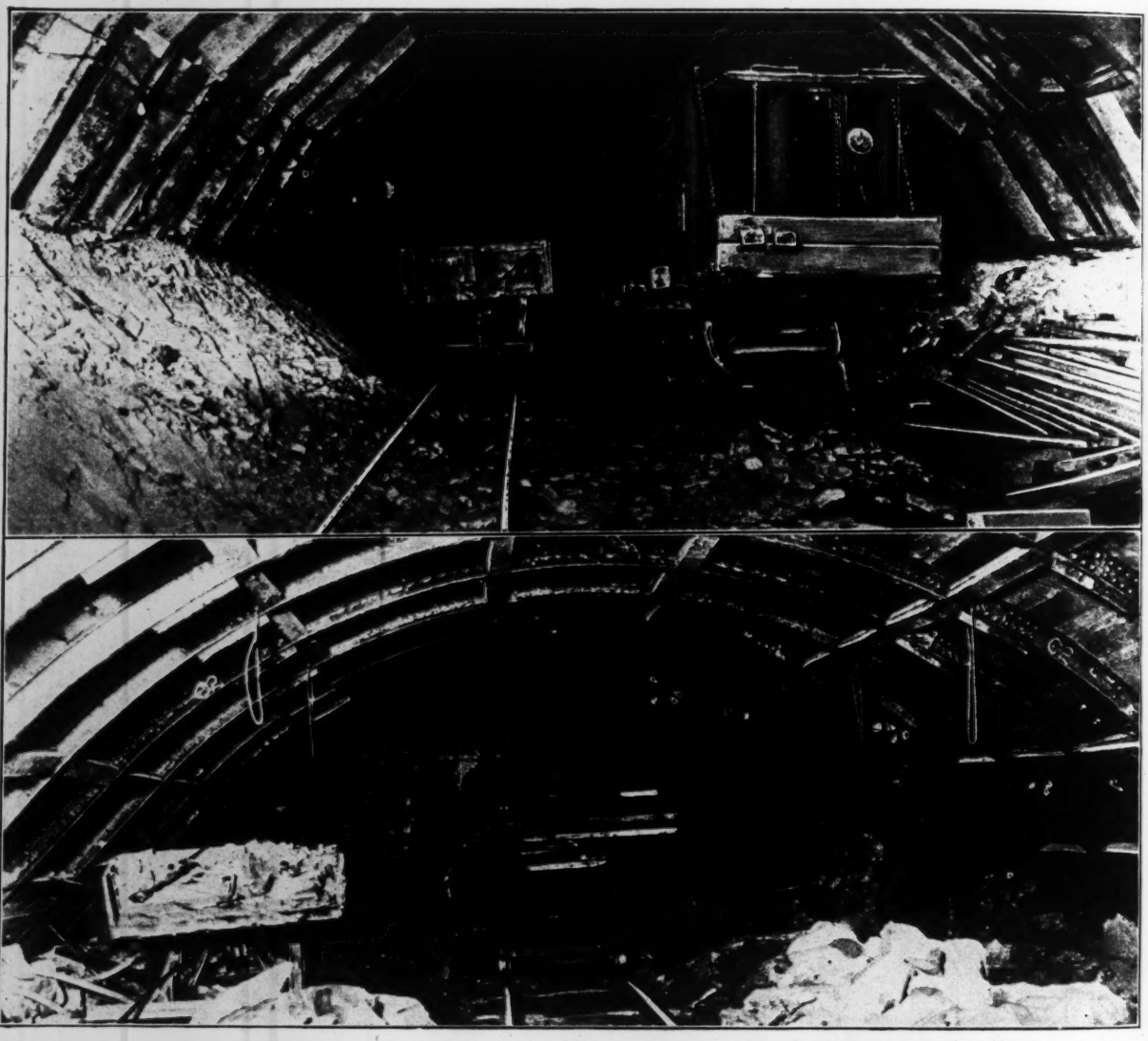
This feature materially assisted in the progress of the work, and we about broke even as to cost.

Steel Segments to Accelerate Tunneling

In a further effort to increase the rate of progress in Stuart tunnel it was decided to use Blaw steel segments to support the roof in place of the usual timber segments. These segments consisted of two 7-in. 14¾-lb. channels, riveted together with two ¾-in. rivets 2½ in. long with fillers 6¾ in. between, at intervals of about 3 ft. 6 in. These segments were divided into three parts, the central portion being 18 ft. 3⅞ in. long curved to a radius of 17 ft. 6 in., the end portions being 11 ft. 3⅝ in. long, 5 ft. ⅛ in. being curved to a radius of 17 ft. 6 in. and the balance tangent to connect with a flanged foot resting on the wallplate.

The three sections were connected with plates 9x¾ in. by 1 ft. 9 in. long and ¾-in. fillers. They were used in 2,015 ft. of this tunnel or for 60% of its length and were spaced for the most part 5 ft. c. to c. and otherwise 7 ft. 6 in. c. to c., depending on the character of the roof. All were tied together longitudinally with ¾-in. tie-rods spaced [illegible] ft. c. to c. The lagging was placed directly on these segments and fastened through $\frac{9}{16}$-in. holes in the flanges of the segments.

The advantages derived from the use of these steel segments were that it enabled the driving to be done more rapidly, as the cross-section was decreased an average of about 2 cu.yd. per lin.ft.; and as these segments came entirely within the section of the concrete lining, there was an additional saving of practically 2 cu.yd. of concrete per lineal foot. Also these sections could be assembled in the tunnel and raised to position with less labor and greater dispatch than the more clumsy wood segments.



FIGS. 2 AND 3. TWO VIEWS OF STUART-TUNNEL HEADING SHOWING STEAM SHOVEL (UPPER) AND THE STEEL SEGMENTS USED

We made speed by the use of these forms, but we doubt if it was a financial success at our first attempt.

Steel Traveler to Build Retaining Wall

A steel traveler and steel forms were used in constructing the intertrack wall located about 1 mi. east of the station at Paw Paw, W. Va., where the new track is

close alongside the old and where the grade of the new track is about 28 ft. above that of the old.

The inaccessibility of the site and the necessity for the continuance of safe and uninterrupted movement of traffic over the main-line tracks indicated the advisability of using a movable platform or traveler (over the tracks), from which operations incident to construction could be safely, economically and expeditiously conducted.

A traveler was specially designed and constructed for the purpose. It was of steel, about 50 ft. long by 34 ft. wide and spanned the tracks. Its height was 35 ft., having a minimum vertical clearance of 23 ft. over the operated main-line tracks. It was equipped with two stiffleg derricks having a maximum working radius of 40 ft. through an arc of about 200°, with a 50-ft. boom. The derricks were set about 6 ft. from the ends of the traveler, on the south side of it. Each derrick was operated by its own hoisting engine set at about the center of the traveler deck.

The traveler was designed to be moved on two ordinary 80-lb. rails, one on each side of the structure, by three trucks of four tandem wheels each, giving a bearing of 12 wheels on each rail, or 24-wheel bearing for the structure.

On account of variation in grade, the rails were supported on heavy timber cribbing to compensate for difference in elevation, as it was necessary to maintain the top of the supporting rail in all places 28 ft. below the top of the wall, which was practically level, while the roadbed of the old track (supporting the traveler) was on a grade.

Movement was effected by power from the two hoisting engines on the platform of the traveler working in unison, with ⅝-in. wire rope wound around the drums passing through a snatchblock attached to anchored cables on each side of the track about 150 ft. ahead of the movement and shackled to the nearest trucks of the structure.

Steel forms were used for the retaining wall, 50 ft. in length and 30½ ft. high, of 2x5-ft. plates, ⅛ in. thick. These were were suspended from a bracket cantilever extension of the traveler, at about the level of the deck or platform, and so equipped with jackscrews and turnbuckles as to be readily adjusted to the exact position desired for line and grade.

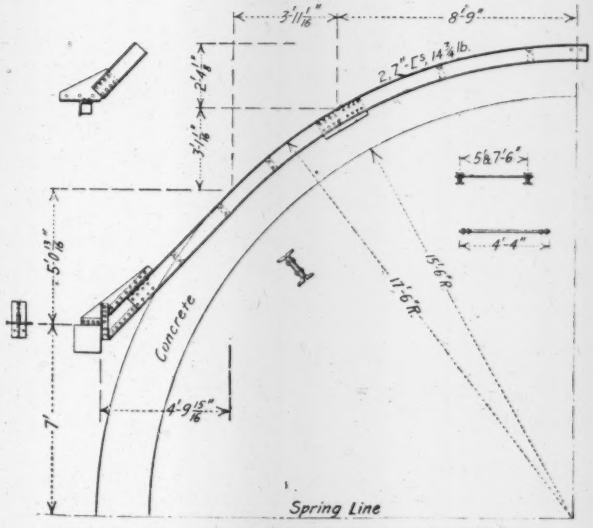


FIG. 4. THE STEEL SEGMENTS AS DESIGNED

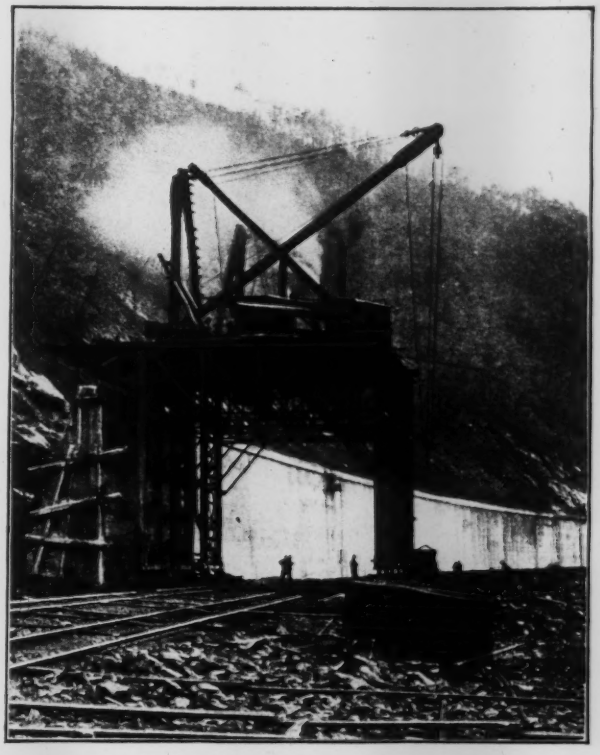


FIG. 5. LARGE STEEL TRAVELER BUILDING RETAINING WALL

The concrete was prepared at a stationary mixing plant located adjacent to the main line of the railroad, in close proximity to the river and about a half-mile west of the site of the wall. It was transported to the wall in buckets on flat-cars by a dinky locomotive over a narrow-gage track. The buckets were removed from the cars and hoisted over and across the main-line tracks to the wall forms by a derrick on the traveler, and the concrete was dumped to place through openings in the platform above the top of the form.

The pressure of the concrete in the form was taken up by wiring, which was passed through ¾-in. holes in the steel plates and around 8x8-in. timber stiffeners bolted to the steel. As the wires were placed around the timbers, wedges were inserted for tightening them, as the movement of the forms indicated. No pressure was permitted against the posts of the traveler.

Where the foundations were deep or wide—and in some places they were 14 ft. below the track, or 11 ft. below neat line—a derrick on the traveler was used to remove the excavated material (in scale boxes) across the main-line tracks, where it was utilized to widen the embankment of the original roadbed. This derrick also handled the concrete used in the foundation of the next section ahead of the form.

The minimum time elapsing between the finishing of one section of the wall and moving the forms to the next section was 15 hr.; but in the greater portion of the wall the forms were undisturbed for two or three days and often for a longer period.

Work of constructing the wall was continued during cold and freezing weather, the forms being insulated with straw and planks on the back and covered with tongue-and-grooved flooring on the face, retaining a 2-in. space

between the steel and the wood, through which low-pressure steam from one of the boilers on the deck of the traveler was diffused by means of a perforated 1-in. pipe. This was laid longitudinally at the bottom of the form for the entire length of the form and connected with the boiler by a T-connection and vertical pipe at about the middle of the section.

The form was designed for the Smith-McCormick Co., which was the contractor on Section 6. Traffic was not delayed, and the result is a very uniform piece of work.

San Francisco's Civic Center

In 1912 a bond issue of $8,800,000 was authorized by San Francisco for the construction of a civic center. Later a total of $3,000,000 additional was made available by donations from the State of California, the Panama-Pacific International Exposition Co. and the Carnegie Library Fund.

Over 21 acres were required for the ground plan of this project (Fig. 1). A suitable nucleus was already owned by the city at a central location occupied by the ruins of the city hall destroyed in 1906. It was necessary to purchase an area of 14.4 acres adjacent to this site, at a price of $4,602,960 before proceeding with the construction.

Structures composing the civic center are grouped around a central plaza, 412.5x618.75 ft. in plan. This park will be ornamented with suitable statuary and fountains. Plaster casts have been set to test the artistic merit of designs submitted for the fountains and statues.

At the west end of the plaza is the city hall (Fig. 2), the dominating structure of the group. Its architecture is Doric, relieved by Renaissance ornamentation of the period of Louis XIV. It occupies a ground area of 287x415 ft., is four stories in height, with a steel frame carrying the granite exterior and reinforced-concrete interior partitions and floor system. Colonnades of granite surround the four corners of the building. At the sides, where the main entrances are located, the colonnades terminate in façades adorned with well-executed sculpture.

The most impressive feature of this edifice is a central dome, 112 ft. in diameter and over 300 ft. in height from the ground to the top of the cupola finial. The

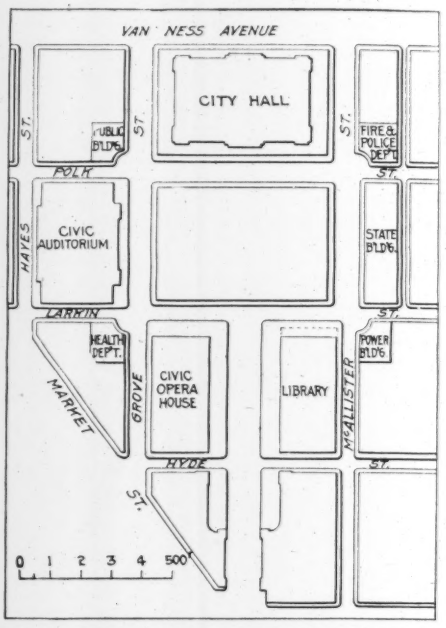


FIG. 1. PLAN OF CIVIC CENTER, SAN FRANCISCO

drum is of granite, surrounded by a colonnade, while the hemispherical cupola is of lead, trimmed with gold.

Beneath the dome is a central rotunda, which forms the main lobby of the building. In the rotunda is an impressive marble stairway leading to the council chamber on the second floor. This room is richly paneled and finished in carved oak. The rotunda extends from the first to the fourth story. Surrounding it on each floor are main corridors from which lateral halls lead

FIG. 2. GENERAL VIEW OF CIVIC CENTER AND NEW CITY HALL, SAN FRANCISCO, CALIF.

to the various municipal departments that are housed in the structure.

Another important unit in the group of public buildings surrounding the plaza is the civic auditorium. This edifice, which cost $1,200,000, was donated to the city by the Panama-Pacific Exposition Co. The main convention hall is 250 ft. square and can comfortably seat 10,000 people, 5,000 on the main floor and 5,000 in the gallery that lines the four sides. An octagonal-pyramidal skylight, supported on open steel trusses, provides excellent light to the main auditorium. Forty-one exits on the ground floor enable the building to be emptied of its largest audience in a few minutes. In addition to the main room the building contains several smaller exhibition rooms and reception halls.

A new public library is now in course of erection within the civic center. This structure is 190x360 ft. over all. Its exterior will be granite, like that of the other buildings of the group. It has three stories. Approached through an imposing entrance and spacious vestibule are the newspaper rooms, juvenile department, department of branch libraries and storage room. On the second floor is the main reading room, 36x190 ft., whose shelves will contain 25,000 volumes and be accessible to the public. The reference room, 30x180 ft., containing the technical library, will also be on this floor, as will the delivery room and a room for special research. On the third floor are located the periodical, music and patent rooms, trustees' rooms and general administration offices.

Construction will be started shortly on a state building to cost $1,000,000, for which bonds have already been sold and plans prepared. A civic opera house, public-health building, fire and police building will follow.

A night lighting scheme very similar to that used at the Panama-Pacific Exposition has been tentatively adopted for the civic center. The indirect lighting plan will display to advantage the imposing granite façades of the main buildings, and searchlights focused on dome and fountains will produce a panoramic effect which cannot fail to impress all observers.

John Galen Howard, Frederick Meyer and John Reed, Jr., constituted the Board of Consulting Architects which, together with A. L. Warswick, Chief of the Bureau of Architecture, had charge of the design of the civic center. The city hall was designed by Bakewell & Brown, the public library by George Kelham and the auditorium by A. L. Warswick who also had general direction of construction details for the entire group.

Modern School Ventilation was described in a paper by Frank G. McCann, presented before the Municipal Engineers of the City of New York on May 24. Attention was called to the general skepticism as to the value of or necessity for mechanical ventilation in school rooms and the great claims made for so-called open-air or outdoor classes. The latter are undeniably wasteful of heat. What constitutes adequate ventilation and the best means of obtaining it has for years been a bone of contention among engineers, medical men, and others, and the end is not yet. At present the New York State Commission on Ventilation, appointed by the Governor, is carrying on a series of tests and experiments to settle the question if possible. The commission includes a sanitarian, a doctor of medicine, a physiologist, a psychologist, and an engineer, and employs a staff of investigators. In the meantime the new school buildings of New York City are being equipped with mechanical ventilation adequate to supply every pupil with at least 30 cu.ft. of fresh, warmed and humidified air taken from as clean a source as practicable. The greatest difficulty in the way of successfully operating a system of mechanical ventilation is a prejudice which many people have for "canned" or "cooked" air.

Old Gravel and Macadam for Brick Pavement Foundation

Brick pavement laid on either a sand or mortar bed directly on an old gravel or macadam road, without a concrete foundation, is considered feasible under certain conditions by H. E. Bilger, Road Engineer, Illinois State Highway Department. The following paragraphs are from an article by Mr. Bilger in the June issue of *Illinois Highways*.

To utilize economically a gravel or macadam road as the base for a brick surface, there is required greater skill than where all the work is to be new. The establishment of the grade line is a delicate matter, inasmuch as a variation of only one inch may require either undue scarifying of the old surface or the unwarranted addition of new gravel or stone which should be united with the old.

In order to establish this grade line properly it is frequently necessary to cross-section the old road at intervals of 50 ft., this depending of course upon the condition of the surface and the regularity of its profile. After having worked out the economic position of the grade line for each station along the line of the improvement, it is usually found necessary that the old surface be scarified to some extent in order that the higher places may be removed to make room for a sufficient quantity of the bed for the brick, and that the lower places may be filled up with fresh gravel or stone to avoid an excessive depth of this bed.

The scarified, reshaped and rolled surface should conform, with a permissible variation either way of ½ inch, to the contour of the finished brick surface. This rolling should be done with the roller used for the subgrade work, and the compaction of the material should be most thorough.

The curb or edging, if used, may be built of concrete having a width of from 4 to 6 in. at the top and from 6 to 8 in. at the bottom, the total height of the edging being from 12 to 15 in. While the edging is not really necessary as a pavement feature, yet its use is recommended because of the great convenience it offers as a guide for the templet used to locate to a nicety the areas to be scarified. The edging would be constructed, of course, before any of the road is scarified. With the edgings completed the road can be scarified and easily reshaped and rolled to the proper cross-section and to an alignment conforming strictly with that of the edgings.

Where edgings are not used it is necessary that there be set up true to line and grade temporary side forms that will carry the templet used as a guide for re-shaping the old road. From the expense of furnishing, setting up and later removing these temporary side forms there is added nothing of value to the completed pavement. In view of this fact, and also in view of the precision of alignment furnished by the concrete edgings, it will be appreciated why the edgings are generally used, and more particularly when it is considered that the top width of each edging acts simply as a substitute for a corresponding width of brick surface. Upon having thus prepared the old road to serve as a base, it is ready to receive the bedding course upon which the brick are set.

While there may be found conditions that would warrant the construction of a new gravel or macadam foundation to carry a brick surface, such conditions are rare.

Grit Chamber and Pump Station, Albany Sewage-Works—II

By John H. Gregory*

SYNOPSIS—Annular suction well, with provision for reversing flow to prevent deposits and a gallery for skimming off floating matter. Three variable-speed and three constant-speed vertical motor-driven centrifugal pumps with automatic master controller and also with normal control. Cost figures for whole works are given. Part I of the article appeared in "Engineering News," June 22, 1916.

The substructure of the pumping station is circular in plan, is 68 ft. in diameter outside and consists of an inner dry well or pump well in which the pumps are located and of an outer or annular well—the suction well (Figs. 5 and 6). Two controlling reasons led to the adoption of a circular substructure—one, that an annular suction well offers certain advantages from an operating standpoint; the other that a circular substructure was the most economical to build under the conditions obtaining at Albany, as the bottom of the substructure is over 25 ft. below normal groundwater level.

The especial advantage of an annular suction well from the standpoint of operation is the possibility of reducing sludge deposits to a minimum while at the same time offering a large water surface and consequent slower change of level in the well due to a change in the rate of sewage inflow into the well and while the pumps are adjusting themselves to the new rate of inflow. This latter feature is greatly to be desired when the pumps are controlled by the level of the sewage in the suction well in such a manner that the rate of pumping will conform automatically to the rate of inflow of sewage into the well, for the reason that a certain minimum period of time is required for the pumps to adjust themselves to the new rate of inflow.

Reversible Flow to Prevent Deposits in Well

From the grit chamber the sewage passes through a suction conduit to the suction well. At the entrance to the well the direction of flow into the well is controlled by a diversion gate, consisting simply of a wooden butterfly gate pivoted on a vertical shaft, which can be so set that the sewage will flow into and through the suction well in a clockwise or counter-clockwise direction, as may be desired. For a better understanding of how the suction well can be operated, reference should be made to Fig. 6. It will be seen that if on any given day, say by the first day, the diversion gate is set as there shown the sewage passes into and through the suction well in a counter-clockwise direction. The maximum velocity of flow, with consequent minimum tendency for deposits to accumulate, occurs at the entrance to the well. This maximum velocity is maintained until the first pump in operation is reached, beyond which point the velocity of flow through the well decreases; and as additional pumps in operation are reached, the velocity of flow still further decreases. The minimum velocity is in the stretch just preceding the last pump in operation; and it is in this stretch, as well as in the stretch beyond this last pump, that the maximum tendency for deposits to accumulate occurs.

By referring again to Fig. 6 it will be seen that, with the flow still in a counter-clockwise direction and with pumps Nos. 5, 6 and 1 in operation, the maximum velocity is kept up for a stretch of more than one-half the length of the suction well and that it is only in the stretch beyond pump No. 1 that there is no velocity at all. This last stretch is obviously a dead end.

If, now, on the next day, say the second day, the setting of the diversion gate is so changed that the direction of flow into and through the well is reversed and is in a clockwise direction and if at the same time pumps Nos. 4, 3 and 2 are placed in operation instead of pumps Nos. 5, 6 and 1, it is evident that the conditions with respect to the velocity of flow through, and the tendency for deposits to accumulate in, the suction well are just the opposite from those on the first day. That is, on the second day the maximum velocity occurs in the stretch which on the first day was a dead end; and if on the first day deposits accumulated in this dead end, the tendency is of course on the second day to remove these deposits and carry them forward with the inflowing sewage to the suction pipes of those pumps which are in operation.

Still further to assist in the removal of deposits, should they occur, it is possible for short periods of time to place enough pumping machinery in service to lower the level of the suction well several feet and thereby materially increase the velocity of flow through the well and especially in the first stretch immediately following the entrance to the well, where on the first day the tendency for deposits to occur was the greatest.

It is intended thus by a combination of reversing the direction of flow and increasing the velocity through the suction well to reduce to a minimum the possibility of having deposits accumulate for any length of time in the well and thereby produce offensive conditions. It will be noticed also in the cross-section of the well, Fig. 7, that the bottom of the well is so constructed, by sloping the sides, that dead corners in which deposits might accumulate have been eliminated.

Gallery for Removing Floating Material

With a coarse screen such as is provided at the entrance to the grit chamber, it is to be expected that some floating material, not necessarily offensive, will accumulate on the surface of the sewage in the suction well and that this material will have to be skimmed off from time to time. From the method of operating the suction well just described it is evident that the floating material will go forward as the sewage flows around through the well and that it will accumulate at the dead end of the well—that is, on one side or the other of the

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diversion gate—on which side, of course, depending on the direction of flow through the well.

To provide means whereby this floating material can be skimmed off, a gallery is built on the inner side of the outer wall of the suction well, the gallery being placed above, and extending to an angle of 45° on either side of, the diversion gate. Electric lights are provided for lighting this portion of the suction well. Access to the gallery is through an entrance passage built on top of the suction conduit and connecting with a platform in the grit chamber. The floating material removed from the suction well will be taken out to the grit chamber and will then be hoisted by the locomotive crane and dumped into a car, in which it will be removed to a point where it will be burned or buried.

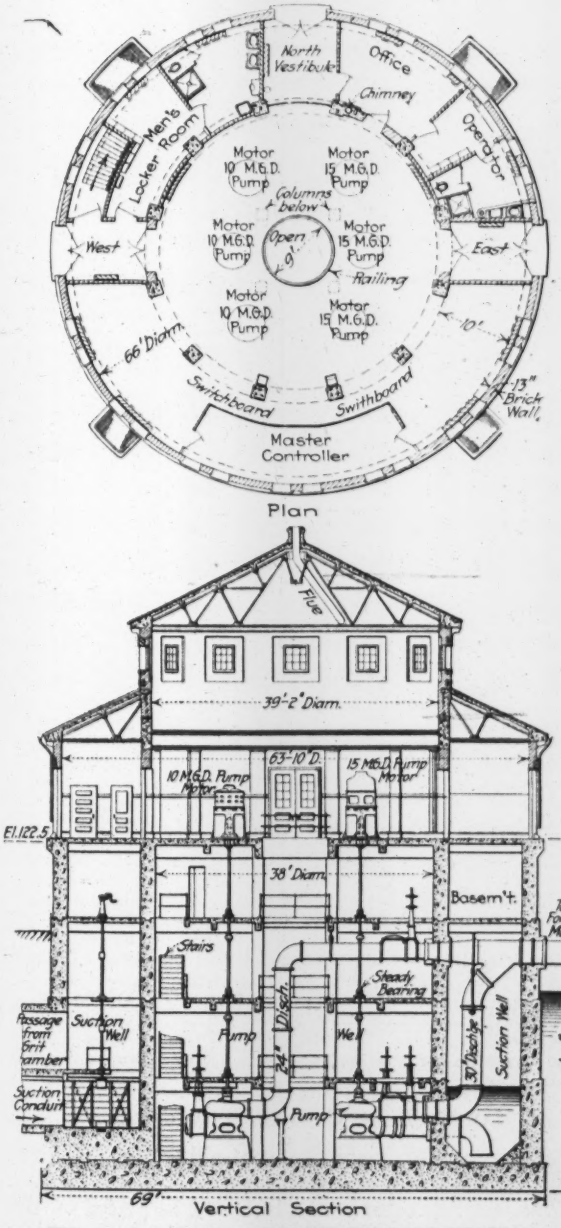


FIG. 5. WESTERLO SEWAGE-PUMPING STATION, ALBANY, N. Y.

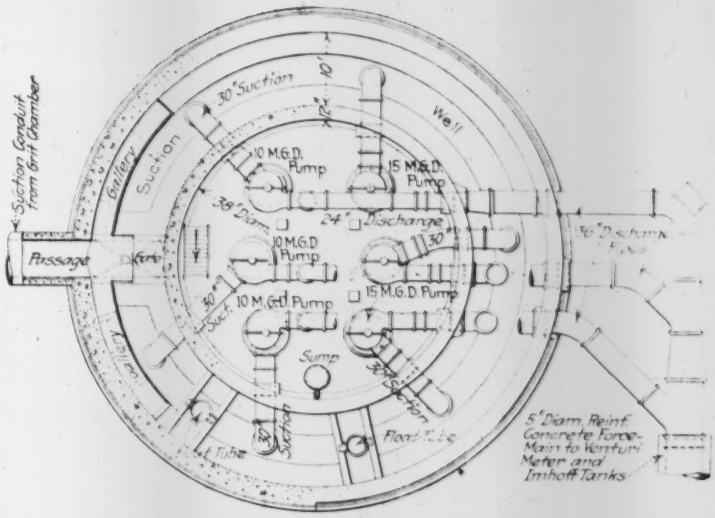


FIG. 6. PLAN OF PUMP WELL AND SUCTION WELL, ALBANY SEWAGE WORKS

The suction well is ventilated by a small motor-operated blower mounted in the superstructure, the suction pipe of which connects with the top of the suction well at a point opposite to the entrance passage from the grit chamber. The blower is of such size that the total volume of air in the suction well can be changed several times in 24 hr.

The upper part of the suction well is roofed over below the main operating floor by a heavy reinforced-concrete floor capable of taking upward water pressure from below, so as to provide a basement in which are located the hot-water heater for heating the superstructure, and rooms for the storage of coal and miscellaneous supplies. Space is also available here for several small machine tools if it should be found desirable to install such equipment.

In the pump well, which is 38 ft. in diameter inside, there are three intermediate platforms or floors, built of reinforced concrete, which serve not only to carry the steady bearings of the vertical shafts connecting the pumps with the motors, but also provide easy access to all the valves on the suction and discharge piping. The intermediate floors are easily reached by stairways having straight runs.

Constant- and Variable-Speed Motor-Driven Centrifugal Pumps

The pumping equipment consists of six centrifugal pumps each connected by an intermediate shaft to a vertical motor set on the main operating floor above the pump well. Three of the pumps have a capacity of pumping from a rated minimum of 5,000,000 gal. to a maximum of 15,000,000 gal. per 24 hr. against a head of 39 ft. and are driven by 150-hp. variable-speed alternating-current motors of the commutating brush-shifting type, with pilot motor for shifting the brushes. These three pumping units will, for convenience, be referred to as the variable-speed pumps. The combined efficiency of the pump and motor is guaranteed to be not less than 60% when pumping 10,000,000 gal. per 24 hr. against a head of 37 ft. When so operating, the rotative speed will

not exceed 385 r.p.m. The motors were purposely kept at a slow speed, even at a sacrifice in efficiency, so as to provide greater reliability in the operation of the pumps.

The other three pumps have a capacity of pumping 10,000,000 gal. per 24 hr. against a head of 39 ft. and are driven by 100-hp. constant-speed alternating-current induction motors. The combined efficiency of the pump and motor is guaranteed to be not less than 64.5%. These three pumping units will be referred to as the constant-speed pumps. The rotative speed of these pumps will be practically the same as that of the variable-speed pumps when the latter are pumping 10,000,000 gal. per 24 hr.

All the motors will operate by a 2,200-volt 3-phase 40-cycle alternating current, which will be obtained from the Municipal Gas Co. and which will be delivered to the motors without any transformation. Should the city at a later date build a refuse incinerator, as has been proposed, the current for operating the sewage-pumping machinery will be generated there.

Master-Controller to Govern Pump Operation

The operation of the pumps will be regulated by a master controller that will automatically as well as manually govern the starting and stopping of any or all of the three constant-speed pumps and the starting, speeding up, slowing down and stopping of any one or two of the three variable-speed pumps over a range in pumping from a minimum rate of 10,000,000 gal. per 24 hr. with one constant-speed pump in service to a maximum rate of 60,000,000 gal. per 24 hr. with three constant-speed and two variable-speed pumps in service, or by the substitution of the third variable-speed pump for one of the constant-speed pumps to a maximum rate of 65,000,000 gal. per 24 hr. For automatically controlling five pumps from all-off position with no pumps running to all-on position with five pumps running, some variation in the level of the sewage in the suction well is required, but this will not exceed a maximum of 7 ft.

The master controller is primarily for the purpose of governing the rate of pumping automatically, but it is also possible to regulate the rate of pumping by manual control. The sewage will be automatically pumped out substantially as fast as it flows into the suction well, and the requisite pump capacity and speed of pumps in service required therefor will be maintained at all times by the master controller, making impossible either the overhauling of the inflow by the pumps so as to empty the suction well below El. 81.75 or the overhauling of the pumps by the inflow so as to allow the level of the sewage in the suction well to rise above El. 88.75. The pumping will be continuous, and the controller will be so designed as to accomplish this result without intermittent operation involving the stopping of all pumps for even very short periods and also so as to make the rate of pumping, or outflow, as smooth and uniform as is consistent with the inflow.

Specifications for Pump-Control System

The specifications require that the control system shall consist essentially of:

A master controller mounted on the master-controller panel of the switchboard.

Two floats with float tubes, each capable of actuating the master controller, with chains, cables and counterweights.

Means for manually shifting the master controller from either one of the floats to the other, for disconnecting one or both floats and for operating the master controller independently of the floats at any time while the controller is in operation.

Means for manually adjusting the float levels at which the master controller performs its various functions so that the level in the suction well, from which any given rate of flow of sewage will be pumped, may be set at the will of the operator, while the controller is in operation, at the highest point consistent with each hour's, day's or week's maximum flow, thereby reducing to a minimum the power required for pumping.

Simple means for manually changing the sequence of cutting in the various pumps so that both constant-speed and variable-speed pumps may be started in any order and their use proportioned so as to insure uniform wear for all three pumps of each kind and so as to permit the use of either a constant-speed or a variable-speed pump as the first pump to be cut in.

Means for automatically changing the speed of the variable-speed pumps gradually by shunt field control, or equivalent means, so that the discharge rate from each pump can be varied from 5,000,000 gal. to 15,000,000 gal. per 24 hr., and for suddenly slowing it down to a rate of 5,000,000 gal. per 24 hr. by a very quick application of full field strength, or equivalent means, during the starting of the incoming constant-speed pump.

Means for automatically starting one constant-speed pump and, if the rate of inflow into the suction well increases, for starting one variable-speed pump at the 5,000,000 gal. per 24 hr. rate, and further, if the rate of inflow still increases, for speeding up the variable-speed pump until the rate of inflow exceeds the discharge capacity of both pumps.

Means for automatically slowing down suddenly the variable-speed pump and for starting a second constant-speed pump and, if the rate of inflow into the suction well increases, for speeding up the variable-speed pump until the rate of inflow overhauls the discharge capacity of all three pumps.

Means for automatically again slowing down suddenly the variable-speed pump, for starting the third constant-speed pump and, if the rate of inflow into the suction well continues to increase, for speeding up the variable-speed pump until the rate of inflow overhauls the discharge capacity of all four pumps.

Means for automatically starting a second variable-speed pump and, finally, as the rate of inflow into the suction well approaches the discharge capacity of all five pumps, for speeding up the second variable-speed pump to maximum capacity of all pumps running.

Means for manually substituting any variable-speed pump for the constant-speed pump first cut in, without otherwise affecting the operation of the controller.

Means for automatically slowing down and stopping all pumps in approximately inverse order to the preceding.

Means for automatically increasing or decreasing the rate of pumping from any rate or master-controller position as the rate of inflow changes within the limits of from 10,000,000 gal. to 60,000,000 gal. per 24 hr.

Means for manually adjusting the limits of automatic field control or equivalent speed-changing device.

Automatic and adjustable time-limit control mechanism for the variable-speed pump speed-changing devices so as to prohibit too rapid change in the speed of the variable-speed pumps. Normal time for change in rate of pumping from 5,000,000 gal. to 15,000,000 gal. per 24 hr., or vice versa, will be approximately 5 min.

Means for manually starting and stopping all or any of the six pumps and for speeding up and slowing down each of the variable-speed pumps independently of the master controller or floats.

Means for visual indication on the master-controller panel of the operating condition of all six pump motors at all times.

Means for interlocking the master controller and the float at the proper relative position when being connected.

Means for protecting the master controller against broken, slack or stuck chain or cable between floats, counterweights and controller.

Low voltage and overload protection with manual reset for all six pump motors.

Manual Pump Control if Necessary

The means for manually controlling the shifting, changing, operating and adjusting just described will be functioned by equipment which will be placed on the front of the master-controller panel and which will be

so arranged as to be easily, quickly and simply workable by one operator standing in front of the panel. In case the master controller is out of service it will be possible for each of the six pumps to be started and stopped and in the case of the variable-speed pumps to have the speed varied manually at the starting panel of the switchboard belonging to each pump motor. The control circuits for the master-controller operations will not be operated under a higher pressure than 125 volts, and no 2,200-volt circuit will be brought to or put on the master-controller panel. The master controller will be so designed as to require a maximum use of the constant-speed pumps.

Provision will be made for allowing considerable change of level in the suction well, according to the rate of inflow and controller position without any change in the motor starters or in the variable-speed motor speed-changing devices, so as to avoid hunting or frequent cutting in and cutting out of motors on the up or the down travel of the floats. The master controller will be designed for greatest stability and minimum changes in pumping rate when sewage is being pumped at a rate of from 20,000,000 gal. to 40,000,000 gal. per 24 hr.; for such a change in the rate of pumping the change in float level, without manual adjustment, will not exceed about 3 ft., and the rise and fall of the float without stopping, starting or changing speed of motors will vary from about 8 to 16 in.

As the pumping machinery will be automatically operated, manual adjustment being required only from hour to hour in order to keep the level of the sewage in the suction well at as high a point as possible so as to economize in the use of power, it is intended to have only one operator on each shift.

Station Superstructure and Venturi Meter

The superstructure is circular in plan and will be of fire-resistant construction. The exterior will be faced with tapestry brick and light Indiana limestone trimmings. The roof will be covered with red Spanish roofing tiles. The pumping-station building, as well as the gate-house and also a toolhouse, has been designed to harmonize with the new buildings which the city and others have erected along, and which have done so much to improve, the Albany waterfront.

No laboratory has been provided either at the sewage-disposal works or pumping station, as all such work will be done in the laboratory at the city water-filtration plant. Separate locker rooms and lavatories are provided for the pumping-station operating force and for the men employed about the works.

On its way to the Imhoff tanks the sewage will pass through a 60-in. venturi meter, the indicating and recording apparatus of which will be placed in the pumping station. A standard Type M register-indicator-recorder, made by the Builders Iron Foundry, will be installed, and especially designed equipment is being made whereby the differential pressure from the meter tube will be transmitted to the operating parts of the register by means of compressed air. Open float tubes containing sewage, or intermediate oil seals, will not be used.

The total cost of the pumping station proper—that is, of the substructure and superstructure, of all the pumping machinery and equipment therein and of the suction and discharge piping to and through the outside wall of the suction well—based on contract prices, will be about $145,920. A division of the total cost and also unit costs are given in Table 1.

TABLE 1. COST OF SEWAGE-PUMPING STATION

Work	Cost Based on Contract Prices* Total	Per 1,000,000 Gal. Daily 1 Ft. High	Per Water Horsepower
Substructure and superstructure	$73,120	$25.00	$142
Pumping machinery and equipment	72,800	24.90	142
Total	$145,920	$49.90	$284

*Unit costs based on total pumping capacity at maximum head: 75,000,000 gal. daily, head 39 ft. = 2,925 million gallons daily 1 ft. high, or 514 water horsepower.

The total cost of the sewage-disposal works, grit chamber, pumping station, piping and miscellaneous work, based on contract prices, but exclusive of land and engineering, will be about $505,680. Giving proper weight to the capacity and cost of the various parts of the work, this total cost is equivalent to a unit cost of $14,310 per million gallons' daily capacity, or $2.87 per capita. The total and unit costs are summarized in Table 2.

TABLE 2. TOTAL COST OF WESTERLO GRIT CHAMBER, PUMPING STATION AND SEWAGE-DISPOSAL WORKS

Work	Cost Based on Contract Prices Total	Per 1,000,000 Gal. Daily	Per Capita
Sewage-disposal works	$277,300	$9,240*	$1.85‡
Sewage-pumping station	145,920	3,240†	0.65§
Grit chamber and other work	82,460	1,830†	0.37§
Total	$505,680	$14,310	$2.87

*Based on average flow of 30,000,000 gal. daily. †Based on average flow of 45,000,000 gal. daily. ‡Based on population of 150,000. §Based on population of 225,000.

The contracts for the construction of the work, other than that for the disposal works, which was awarded in 1914, were awarded in 1915; that for the construction of the grit chamber and pumping station to the Foundation Co., of New York, and that for the installation of the pumping machinery and equipment to R. D. Wood & Co., of Philadelphia. The electrical equipment, except the control system for the pump motors, which is being made by the Thompson-Bonney Co., of Brooklyn, will be of General Electric Co. make.

The grit chamber, pumping station and sewage-disposal works are being built under the direction of the Department of Public Works, Wallace Greenalch, Commissioner, and Frank R. Lanagan, City Engineer. Stephen B. Vernon, Engineer Intercepting Sewer Design and Construction, is in immediate charge of the construction. The plans and specifications for the grit chamber and pumping station, as well as for the disposal works, were made by Hering & Gregory, of New York, under the immediate direction of the writer.

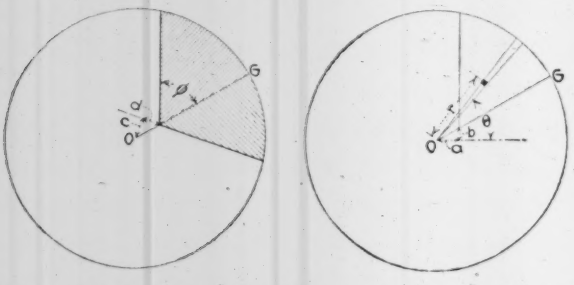
Call for Competitive Designs Creates Obligation — The Swiss Federal Court recently decided that, when a public authority calls for competitive designs, it creates a condition of implied contract between the letting authority and those who submit designs in accordance with the call. A district school board some years ago issued to five architects an invitation to submit competitive designs. After the designs were submitted, no decision was made, and the question of proceeding with construction of the building was postponed from term to term. Finally, without previous warning, the board announced that it awarded the commission for design of the schoolhouse to an architect who had not been in the competition. Even at this date no decision of the jury of competitive design was made known. One of the competitors then sued for reimbursement; and at the trial the district board presented a jury report, which, however, showed neither date nor signature. The plaintiff's claim for reimbursement for the plans furnished was denied by the lower court, but was upheld by the highest court, the reversal being based on the implied-contract theory. The compensation that was awarded was directed to be according to customary practice. The case is fully reported in the "Schweizerische Bauzeitung" of May 27, 1916.

Sphere Cut by Any Two Planes; Volume of Slice

By James E. Boyd*

The following calculation adds new matter to the discussion of the sphere-segment problem in *Engineering News* of Mar. 16, 1916. It treats a more general problem—that in which the planes defining the segment are at any angle (not necessarily 90°).

When two planes intersect in a sphere, the slice which they cut out of the sphere may be divided into two portions by a plane through the intersection of the two planes and the center of the sphere. To find the



volume between this plane through the center and one of the others, we use cylindrical coördinates with the Y-axis parallel to the line of intersection of the planes.

The element of volume is $r\,d\theta\,dr\,dy$. Integrating first with respect to y, with limits $y = -\sqrt{R^2 - r^2}$ and $y = +\sqrt{R^2 - r^2}$, and then with respect to r, with limits $r = a \sec\theta$ and $r = R$, we get

$$Volume = \tfrac{2}{3}\int (R^2 - a^2 \sec^2\theta)^{\frac{3}{2}}\,d\theta$$

Substituting $x^2 = R^2 - a^2 \sec^2\theta$, we get

$$Volume = -\frac{ax}{3}\sqrt{R^2 - a^2 - x^2} + \left(aR^2 - \frac{a^3}{3}\right) sin^{-1}\frac{x}{\sqrt{R^2 - a^2}} + \frac{R^3}{3}\left(sin^{-1}\frac{R^2 - Rx - a^2}{(R - x)\sqrt{R^2 - a^2}} - sin^{-1}\frac{R^2 + Rx - a^2}{(R + x)\sqrt{R^2 - a^2}}\right) \qquad (1)$$

The last two terms combine to

$$-\frac{R^3}{3} sin^{-1}\frac{2aRx\sqrt{R^2 - a^2 - x^2}}{(R^2 - x^2)(R^2 - a^2)}$$

The limits are a sec $\theta = \sqrt{a^2 + b^2}$ and a sec $\theta = R$; the corresponding values of x are $\sqrt{R^2 - a^2 - b^2}$ and 0. Inserting these,

$$V = \frac{ab}{3}\sqrt{R^2 - a^2 - b^2} - \left(aR^2 - \frac{a^3}{3}\right) cos^{-1}\frac{b}{\sqrt{R^2 - a^2}} + \frac{R^3}{3} sin^{-1}\frac{2Rab\sqrt{R^2 - a^2 - b^2}}{(R^2 - a^2)(a^2 + b^2)}$$

The last term frequently represents an angle greater than 90° and is sometimes rather ambiguous. The angle of this term reduces to

$$Sin^{-1}\frac{R\sqrt{R^2 - a^2 - b^2}\,sin\,2\phi}{R^2 - a^2}$$

where ϕ is the angle between the plane through the center of the sphere and the first plane. It is evident that, when ϕ is greater than 45°, this term will usually represent an angle greater than 90°. In a doubtful case it is necessary to go back to the separate terms of equation (1).

The expression for the volume of the remaining part is the same with c and d in place of a and b respectively. When the planes are at right angles to each other, a and b are interchanged in the second part of the total expression. The total volume in this case is

$$\frac{2ab}{3}\sqrt{R^2 - a^2 - b^2} - \left(aR^2 - \frac{a^3}{3}\right) cos^{-1}\frac{b}{\sqrt{R^2 - a^2}} - \left(bR^2 - \frac{b^3}{3}\right) cos^{-1}\frac{a}{\sqrt{R^2 - b^2}} + \frac{R^3}{3} sin^{-1}\frac{2Rab\sqrt{R^2 - a^2 - b^2}}{(R^2 - a^2)(a^2 + b^2)} + \frac{R^3}{3} sin^{-1}\frac{2Rab\sqrt{R^2 - a^2 - b^2}}{(R^2 - b^2)(a^2 + b^2)}$$

the last two terms of which combine to

$$\frac{R^3}{3} sin^{-1}\frac{2Rab\sqrt{R^2 - a^2 - b^2}}{(R^2 - a^2)(R^2 - b^2)}$$

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Effect of Government Control on British Railways

Shortly after the outbreak of the war the British Government took over the control of all the railways of Great Britain. The railway managers and their staffs were unchanged, but the entire railway system was placed under control of a railway executive committee composed of the general managers of all the different railway companies with the President of the Board of Trade as the Chairman.

The arrangement by which the railways were taken over provides that the government pay to the respective companies, for distribution among their bond and stockholders, the same net earnings per annum as the companies earned in 1913. The government stands any losses due to earnings falling below this scale and benefits by any profits where the earnings rise above it. One important effect of this arrangement is that competition between the different companies is at an end, since there is no object to be gained by it and traffic is handled on all the lines as if they were a single system under a single ownership. *The Engineer* (London) in a recent issue enumerates the advantages which have developed through this system of unified control and the elimination of competition as follows:

To utilize the railways to the best all-round advantage and to give all a share in the work to be done is part of the duties performed by the Railway Executive Committee. It stands to reason that with all the railways worked as one system, and the consequent sending of all traffic of first importance by the shortest route, traffic of the second class by another route, and so on, there is greater expedition. The sending of traffic by selected, uniform, regular routes insures better loading of wagons, less shunting en route, and therefore cheaper transit. It also means that goods sheds have fewer towns to receive goods for, and that consequently there is less trucking, more space for drays, and that the shed area is better divided up. In the larger towns where there are several goods terminals the inbound traffic arrives with greater regularity and can be disposed of more rapidly and at less cost in labor. The common use of two-thirds of the railway-owned open wagons is another achievement that has been made possible by the state guaranteeing the net receipts of the companies, as the latter are no longer concerned over the cost of the upkeep of their wagon stock; all that matters now is an adequate supply of wagons. This arrangement reduces empty haulage and so allows for more profitable train loads, more loaded mileage per wagon, and it calls for less shunting.

Investigations for Dam and Reservoir Foundations

By Caleb Mills Saville*

SYNOPSIS—Reconnoissance for location and thorough underground exploration of the tentative site or sites are essential. When wash borings are employed, great care must be exercised to save and study all the material brought up. The diamond drill cannot be excelled for rock exploration. Special apparatus for testing drill holes for watertightness described. Grouting is an auxiliary protection for some rock foundations, but is not a reliable substitute for solid rock. A table shows foundation failures of various types of dams.

Questions pertaining to foundations are among the most important matters for consideration and study in the design and construction of dams. A very large proportion of failures of these structures is directly traceable to faulty or insecure foundations, and it is probable that many failures assigned to other causes have their beginnings in weakness at this point. Improper interpretation of facts, often accompanied by neglect or contempt of natural laws, is in most cases responsible for the lack of stability. Each kind of dam has problems peculiarly its own, and every location is a law unto itself. Each particular site requires individual study to provide properly against sliding and uplift pressure in the case of masonry dams and against undue leakage and possible undermining in the case of earth dams and those of other types with improperly constructed cutoffs, especially those not founded on rock. Besides the foregoing and of lesser importance only because dollars and not human lives are being safeguarded, are questions bearing particularly on methods to be used during construction.

Several dams have been designed and constructed recently under the writer's supervision for the additional water-supply of the City of Hartford, Conn., and several years earlier he was in charge of investigations of the foundations, available materials and methods of construction for the Gatun dam and other dams proposed for the Panama Canal. It is here proposed to state some of the facts drawn from experience on these works, from which in combination with the reported experiences of others elsewhere, it is hoped to draw conclusions that may be helpful in the study of similar conditions or be broadly applicable to questions relating to foundations.

While the subject of this paper and the examples relate to foundations for dams, the principles herein set forth are fundamental to all manner of deep foundations, particularly those for bridge piers, tunnels, subways and heavy buildings.

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Reconnoissance the Most Important Preliminary

A most important preliminary to the construction of a dam is the reconnoissance for the purpose of selecting the best tentative location. The type to be followed for a particular locality, if it combines safety first with economy a close second, is a masterpiece of engineering construction. The first studies for design are very closely related to impressions gained from inspection of the ground, and much time and expense are saved if this work can be undertaken with confidence that subsequent investigations will justify tentative decisions. The proper interpretation of topography can be given only when judgment is guided by understanding of geology and physical geography. This knowledge, however, must be that of the engineer trained to concentrate his mind on limited areas rather than that of the topographer or geologist, to whom, as a rule, with his practically unlimited vision, local happenings do not make strong appeal.

Surface appearances should not be given too great weight in deciding on the location for a dam of any magnitude. The final decision should be made only after a most thorough underground exploration of the entire site. In limestone countries or locations where there has been much faulting or movement of rock areas persistent examination should be made for caverns, altered or disintegrated dikes, faults or rock formations likely to be

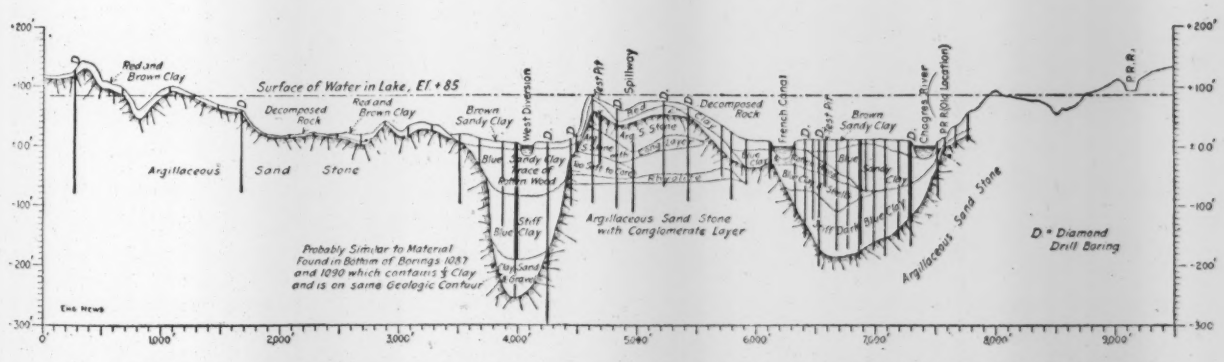

FIG. 1. PROFILE ON THE AXIS OF THE GATUN DAM SITE, SHOWING UNDERLYING MATERIAL AS DETERMINED BY BORINGS

From report of C. M. Saville, Assistant Engineer, Aug. 29, 1908, as reproduced in "Engineering News," Dec. 24, 1908

affected chemically or physically by the conditions that will obtain after the work is done. In regions with gravel deposits, especially those which have been subjected to glaciation, exploration should be made for saddles in the ridges filled with deposits that may offer a chance for water to seep through. The divide between the proposed basin and neighboring watersheds should be studied not only for the purpose of taking measures to prevent leakage, but also, more important still, because such topography usually indicates local structural weakness in the rock formation, from which valuable conclusions may be drawn regarding the dam site itself.

Such exploration as this was made through all the ridges around Gatun Lake, especially to the north and east. Similar investigations, followed by adequate methods of construction, as reported, have made the 108-ft. Beaver Park dam in Colorado a success, while a lack of such precautions and possible misapprehension of facts has thus far made Cedar Lake reservoir at Seattle a failure, with the probability of an expenditure of a very large sum of money for additional construction, if indeed it is found possible to use the dam at all. Such conditions were encountered in a small dam built for the City of New Britain, Conn. Here sheetpiling was driven into a gravel formation to provide a cutoff, and the ends of the dam were stoped in gravel hillsides. After the reservoir was filled, excessive leakage took place, to such an extent that the downstream portion of the embankment became saturated and began to slide. Remedial measures were undertaken; and while it was deemed impracticable on account of expense to stop all leakage, sufficient work was done to enable the dam to be used. The cost of repairs to assure safety was nearly 30% of the original cost of the dam, and it was estimated that at least as much more would have been required to make the structure tight.

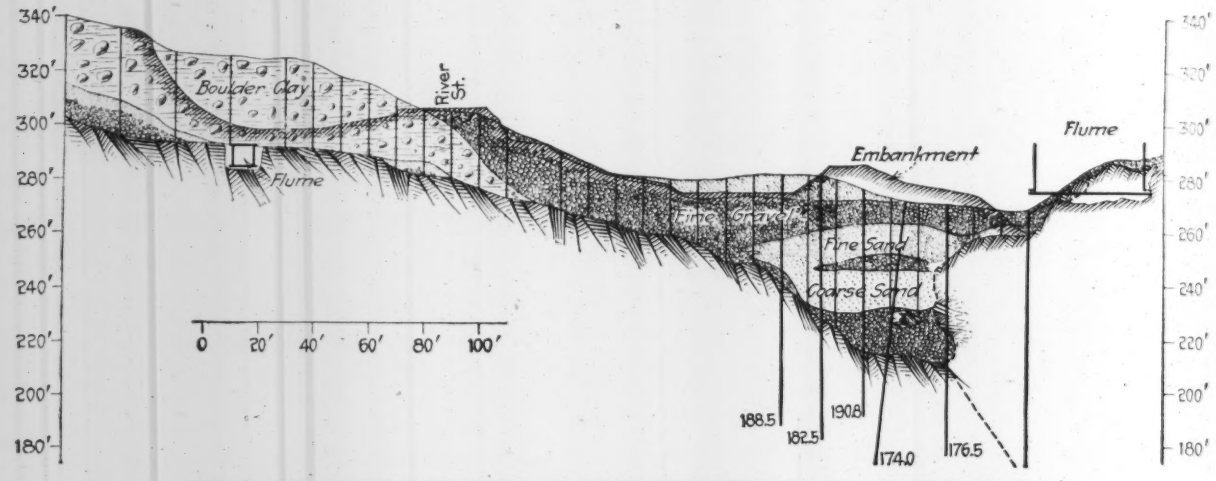

FIG. 2. PROFILE OF ROCK SURFACE AT WACHUSETT DAM SITE, CLINTON, MASS.
Wash borings in light lines; diamond-drill holes in heavy black lines

The rock profile of the dam site at Phelps Brook on the City of Hartford work illustrated the uncertainties of surface indications and showed the depths at which bedrock may lie in deep pockets of limited extent, due to the plowing out by the glacier of soft or broken material along earlier fault planes.

The profile of the Gatun dam site (Fig. 1) shows the carving of rock formation by prehistoric streams and the subsequent over-burden of alluvial material after the subsidence of the rock floor. Similar conditions, due to the work of a preglacial stream and the subsequent filling of the gorge by glacial deposits, are shown in the profile of the rock surface at the Wachusett dam site (Fig. 2) at Clinton, Mass., and of the Nepaug dam at Hartford.

FIG. 3. COMPARISONS OF WASH AND DRIVE SAMPLES TAKEN BY WASH DRILL; NEARLY FULL SIZE

Preliminary to the final decision of the type of dam to be constructed, a thorough exploration should be made of underground conditions. Test pits, well drilling, wash borings and core drillings are the most convenient methods for this purpose. Each has its advantages and limitations. Test pits give the best and most complete information of the materials passed through. They are often difficult and expensive to excavate, except to comparatively shallow depths, and there is always the chance of encountering a big boulder and mistaking it for ledge rock. Next to test pits, well drills of the Keystone type give the best information in soils where the device can be used. Samples are taken by dropping a heavy hollow steel core barrel into the hole and using an engine and windlass to raise the drill. The core barrel takes a sample about 2½ in. in diameter and 18 in. long. In materials that are not too wet and have sufficient clay or silt to cause some cohesion a nearly continuous cylinder can be obtained of the underground materials to great depths. Satisfactory samples have been taken for the writer at a depth of 185 ft. in the foundations under Gatun dam.

Wash borings are comparatively inexpensive; and if the results are interpreted by an experienced and reliable

FIG. 4. BLOWOUT UNDER CANAL EMBANKMENT, ANSONIA, CONN.

man, very good information can be obtained. The danger lies in failure to consider *all* of the material brought up by the wash water, and on this account an erroneous classification of underground formation often results. It is also practically impossible to distinguish between boulder and ledge rock by means of a wash-drilling outfit, no matter how expert the operator.

An example of such conditions is shown on the Wachusett gorge section, Fig. 2. The wash borings at the embankment shown at the right of the section were stopped by a large boulder that the intermediate diamond-drill hole passed through. Again, the diamond-drill hole at the extreme right of this dip in the rock surface is shown as passing through an overhanging ledge of rock. In both of these cases interpretation of the wash borings alone would probably have resulted in a mistaken location of the solid-rock surface. Similar conditions appeared when both the Nepaug and the Phelps Brook gorges were excavated. In the former case the drill hole barely missed a huge boulder lying directly on solid ledge, and in the latter case a test pit was stopped at what appeared to be firm ledge, but was afterward found to be a very large boulder lying a number of feet above the actual rock bottom.

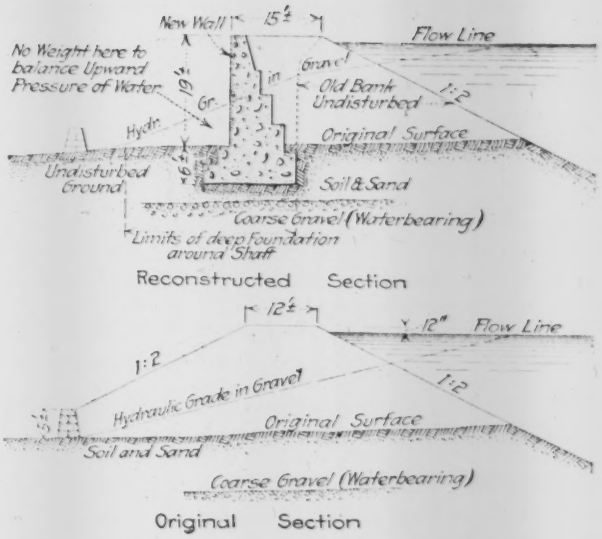

FIG. 5. ORIGINAL AND RECONSTRUCTED CANAL EMBANKMENT, ANSONIA, CONN.

Wash-drilling apparatus consists essentially of an outside casing pipe and an inside pipe terminating in a cutting tool that has different shapes, depending upon the material to be drilled. Water under pressure is forced down the inner pipe, which is jerked up and down by men or machinery. There is an outlet in the tool at the bottom, through which water can escape. The action of the tool breaks up the material at the bottom of the hole, and the force of the water raises it to the top of the casing pipe, where it is caught in buckets for examination. It can readily be understood that the underlying material is completely disintegrated by the action of the tool and the water. If care is not taken therefore to save *all* of the material washed up, most of the finely divided clay will be lost and the resulting sample seem to indicate coarse clean gravel through which water might easily find its way, while in place the layer penetrated actually may be so tightly cemented together with clay and sand as to be practically impervious to water. Such conditions as these are obviated to a great extent by taking "dry," or "drive," samples, which is done by shutting off the water, unscrewing the drill point and driving the open pipe down into the layer. When withdrawn from the hole, the bottom of

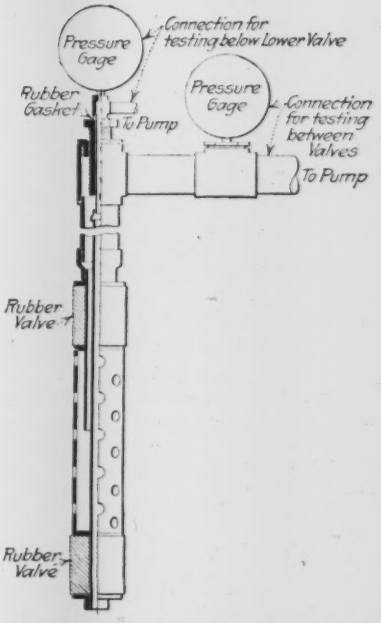

FIG. 6. APPARATUS FOR FOUNDATION INVESTIGATIONS, HARTFORD WATER-WORKS

the pipe is filled with a cylinder of the material as it actually occurs. Such methods as these were used in the exploration of the foundation for the Gatun dam and samples obtained from identical locations by drive and wet methods are shown by Fig. 3, these samples being taken at depths of over 200 ft. Some of the earlier explorations in this locality resulted in samples that caused considerable uncertainty as to whether or not it was possible to build a stable dam at Gatun. Later and more extensive investigations gave evidence that the site was a safe one, provided proper methods of construction were used, and the Board of Consulting Engineers approved this conclusion.

A guide to the rate at which water will flow through gravelly or sandy material may be had by mechanical analyses of the samples and by recourse to the methods of determining the flow of water through sands and gravels as deduced by Allen Hazen (Massachusetts State Board of Health, 1892) and by Professor Schlicter (United States Geological Survey, W. S. and I. Papers Nos. 67 and 140). Valuable information can be obtained by the electric method of determining underground flow, devised by Professor Schlicter. The best practical information can quickly be had from the study of groundwater heights in a series of test pits or driven wells at the dam site itself.

With a knowledge of the drainage area tributary to the holes and an estimate from the rainfall or from neighboring stream flow of the probable amount of water passing the given point, it is possible to make a reasonable prediction as to what will be the probable rate of flow through the given material after the dam is built and the water surface raised to a given height. If with the estimated flow through the given material after the dam is built the hydraulic gradient is kept well below the surface of all portions of the constructed dam, there can be no danger of failure from blowouts, although there may be comparatively large leakage.

Serious spring flow or sloughing of the downstream slope of earth dams usually results when the hydraulic gradient cuts the downstream slope above the original ground surface. Under these conditions there is ever present the danger of the undermining of the dam and consequent failure. The result of such conditions is shown in Fig. 4, taken after the failure of the canal embankment at Ansonia, Conn., in May, 1912. Possible circumstances leading to this failure are indicated in the sections of the embankment before and after reconstruction, shown by Fig. 5.

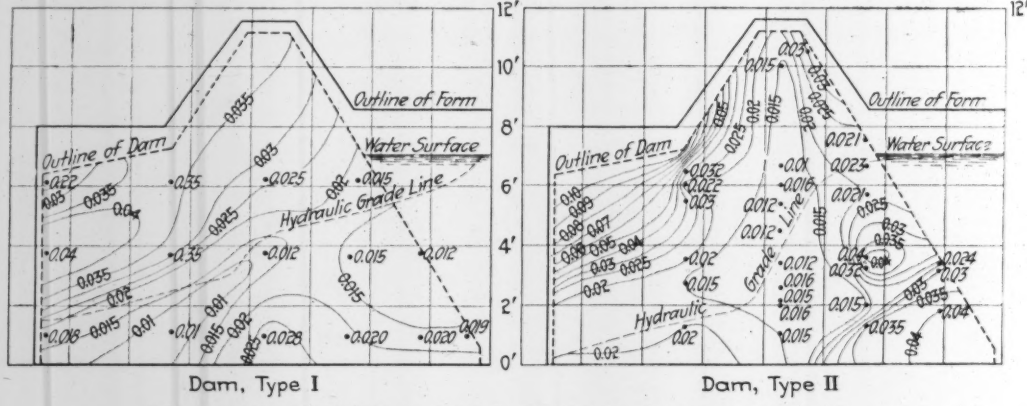

FIG. 7. EXPERIMENTAL DAMS CONSTRUCTED AT GATUN DAM SITE

The two diagrams given above show effective sizs and relative distribution of materials as deposited; also hydraulic grade lines of dams. From Appendix E, Isthmian Canal Commission, Report of June 30, 1908. Dam, Type I—Materials deposited on downstream slope of dam and allowed to flow to upstream slope. This method deposited the finest material on the upstream face. Dam, Type II—Material deposited on both slopes and allowed to flow to center of dam. This method deposited the finest material in the center of the dam

Diamond Drill Best for Rock Exploration

In rock exploration some information can of course be had from holes driven by the ordinary rock drill, but by far the most satisfactory information comes from the cores obtained by the diamond drill. In certain kinds of rock and under right conditions just as satisfactory results at less expense can be obtained with shot drills or with those having a cutting edge of chilled steel. For all-around work, however, no tool has yet been devised that equals the diamond drill.

Essentially this drill consists of a hollow cylinder 3 or 4 in. long set with six or eight "black diamonds," alternating inside and outside the cylinder and forming the cutting tool of the drill. This cylinder is attached to the end of a hollow rod, and by rotating the drill an annular space is cut into the rock, leaving a central core to pass up into the end portion of the hollow rod, called the "core barrel." To prevent heating due to the rotation of the drill, water is forced down through the hollow rods and plays over the cylinder containing the cutting diamonds. Depending on the size of the cylinder and the number of diamonds set, cores of practically any size can be taken. The usual sizes range from about 7/8 in. to 3 in. in diameter. Hard rocks core best, but satisfactory results can be obtained with a double-core barrel from soft and friable rocks or from those, like mica schist, where the parting planes are nearly vertical.

In the study of foundation conditions, especially those requiring stability and water-tightness, some knowledge of geology is essential for correct interpretation of the data obtained from the underground exploration. The structural features of the underlying rock and its soil cover are of the utmost importance, and geologic profiles are of great help in making preliminary decisions. For this purpose the general geological maps of the locality, published by the United States Government, give an idea of the general rock formation in the vicinity of the proposed work. Based on the known characteristics of such formation, the underground survey for a special

site is laid out so as to cover and bring out peculiarities.

Hydration is one of the chief factors in the decomposition of all rocks. Within the limits of ordinary foundation work there is almost no such material as solid rock. Joints and seams in the igneous and metamorphic rock, bedding planes in the sedimentary rocks or cavities in the limestone afford easy access for surface waters to penetrate to great depths. With these things in mind the rock cores should be carefully examined.

For example, at the sites of all the dams of the Hartford additional water-supply metamorphic rock is the country formation, consisting of gneiss and mica schist. The outcrops and drill cores revealed both joints and planes that might freely afford passage for water. This condition was important for two reasons: First, because it would be required to search out and stop these channels in order to prevent water from penetrating beneath the dam and causing uplift pressure under the masonry or excessive leakage under the earth embankments; second, because it is known that when water travels underground it usually carries in solution carbonic, humic and other acids that may cause a breaking down of the rock and the formation of slick, unguentous layers that will act as a lubricant to facilitate the sliding of masses of rock or masonry.

Besides this, under certain conditions joints and seams, although originally solidly filled with apparently watertight material, will, if opportunity is given, blow out, leaving an opening oftentimes of considerable width. On the other hand, intruded pegmatite dikes often entirely cut off these joints and form a tight water-stop. If, however, the feldspar contents of these dikes have been dehydrated to such an extent that they may break down into kaolin when exposed to water, another difficulty has been encountered for which a remedy must be found. The most disturbing conditions were found in fault zones where either the schist itself was twisted and crushed almost to powder or else the movement of the rock mass had broken an intruded dike into fragments, leaving a more or less loosely filled channel through which water can find its way.

The ordinary course of water through rocks of this kind is, however, zigzag from joints to planes of bedding, and the stoppage of either class of these openings renders the rock practically impervious. Such conditions, therefore, are not so serious in hard rocks as in the case of limestone, where the action of the water may dissolve a channel, or in the case of sedimentary rocks, where inlet along bedding planes may be had to wide areas, with the result that the entire mass may slip, or uplift pressure may be applied under the whole structure. In estimating the amount of rock excavation necessary to get a satisfactory foundation it is important to know to what extent the different rock formations decompose on the surface underneath the soil cover. This depends upon the constituents of the rock, the character of the water and the nature of the overlying soil.

Many rocks when first uncovered are seemingly sound and solid, but after exposure to the air disintegrate and fall apart in a short time. Much of the rock excavated in the Gaillard Cut of the Panama Canal had this nature, and it was necessary to consider such action in seams of hydrated mica schist in the dam foundations at Hartford. This characteristic can be guarded against and a perfectly strong and stable foundation can be provided.

Every zone of faulting presents lines of weakness in rock formations, owing particularly to the slipping and distortion of strata brought about by shearing strains due to earth movements. This condition was encountered on a small scale in the foundations for the dams of the Hartford additional water-supply, as mentioned. On a much larger scale this phenomenon was exhibited on the Isthmus of Panama, and to its results can possibly be traced the trouble that has been experienced with slides and filling of the canal prism. It is not improbable that much of the weakness observed in the formation in the vicinity of Culebra Cut may be attributed to the extremely abundant faulting that has taken place in that locality, due to the wrinkling and folding of strata in the vicinity of the continental divide. The rock material is a very loosely cemented volcanic ash that rapidly disintegrates upon exposure to the air. Owing to the extremely deep cutting at this point, large amounts of water from the excessive tropical rains have obtained easy access to the rock along fault planes and dikes. Under this exposure formations that under normal conditions would have remained solid and firm have disintegrated into instable argillaceous earth. As a result of this transformation two conditions have obtained: First, the material in the canal sides, becoming soft and slippery, flows along its own angle of repose to fill the excavated ditch; second, the vast weight of the side of the cut, towering up from 250 to 300 ft. above the bottom of the prism, has put a burden on the underlying rock too great for it to bear in its weakened state. The heaving up of the bottom of the canal is the inevitable result.

Another example of the danger to be encountered in foundations, due to change in the character of the rock, is found in the comment by the State Geologist of Tennessee on the failure of a reservoir wall at Nashville (*Engineering News*, Nov. 16, 1912):

> It is not impossible that at the time the wall was put in the clay layers were hard calcareous shale, and to a person not familiar with the changes that occur would appear to be of lasting quality, but they . . . alter to clay, and these clay layers with the dip of the rock (3° to 5°) upon which the heavy wall stood would in time cause the slippage that actually took place.

Some of the clay or altered schist layers in this foundation were as much as 10 in. thick, and to a depth of 4 ft. below the surface had become extremely soft.

Another peculiarity of some rocks is expansion when uncovered and exposed to summer heat. Under such conditions the laminæ will often buckle and crack, loosening quite a large area of seemingly solid rock. It is on the face of the stratum that this action takes place, the ends of the stratum when exposed being little if any affected.

As previously stated, the means of getting information concerning underground conditions are from samples taken from the test pits or borings. Some idea of the tightness or openness of the rock formation may be had from the action of the wash water at the drills. If the water comes freely to the surface, the openings, if any, are probably small. If, on the other hand, water does not appear at the surface, it is safe to assume that an open seam has been encountered. If the drill holes are pumped out and observations made, first, of the rate at which they fill and after that of the rate at which water is lost when the hole is filled to a higher elevation than that at which water naturally stands, additional information can

be obtained. Most reliable data can usually be had by testing with air or water under considerable pressure, delivered through a meter whereby the amount and rate of flow can be obtained.

By means of specially devised testing apparatus it is possible to plug the drill holes at any desired depth and by forcing in water obtain information foot by foot. Fig. 6 is a form of plug used in testing rock for leakage from diamond-drill holes. By pursuing these methods from hole to hole, underground seams may be traced for long distances. When water is forced into holes under pressure, if there are openings the water will appear at other holes and along exposed seams. One of the most effective methods of detecting loose and seamy rock is by means of air or water pressure. Oftentimes by these means comparatively large areas of supposedly solid rock will be blown off, and ledge faces that appeared to be tight will show seams of clay or soft rock that might otherwise have been overlooked. In testing rock there is nothing better than pressure water to search out and expose weak places.

For tightening up under-surface seams in rock that is otherwise suitable for foundations the method of forcing in cement grout has been used with great success. Under proper conditions it is a very economical means of obtaining satisfactory foundations in rock where otherwise there would be much leakage or considerable expense in excavating unsound rock and refilling with masonry. The method of procedure is entirely similar to that of testing the bore holes for leakage which has been described above, cement grout being used instead of water and the process being continued until all seams in the vicinity of the hole are tightly plugged with the liquid cement, which after a time will harden and solidly fill the opening.

Some General Considerations

In foundations any bedrock that is of uniform structure usually has sufficient strength under ordinary conditions of loading to support a heavy masonry dam. If the rock is weak or thinly bedded, it should be thoroughly protected against sliding of strata, due to interbedded layers of shale or clay, and from erosion below the overflow, due to falling water. Grouting should be relied on only as an auxiliary precaution and cannot be considered as an efficient or reliable substitute for thorough excavation into firm rock.

In the case of dams of earth or reinforced concrete, more or less tight, sheetpiling driven some distance into underlying gravel should not be substituted indiscriminately for wide and heavy earth embankments or for a well-built cutoff carried to bedrock and sealing the entire width of the valley. With dams founded on porous or semiporous material, chances abounding with grave possibilities are taken when such an impervious cutoff is omitted. Only the most experienced judgment should be called on to balance the cost of such construction against the risk of blowout. Where one human life may be placed in jeopardy, a dam should be built safe beyond human conception of hazard. In all dams the position of the hydraulic grade line between the limits of heel and toe for full reservoir is a most reliable index of safety in studying questions of dam foundations, and the design of the structure should be such that this line can be kept well within safe limits.

A properly constructed cutoff is foolproof, but may be expensive. A wide embankment is often the cheaper and is perfectly reliable if underground conditions are known and taken into account. The safest place for the latter construction is in localities where the materials in the foundation are of uniform character and of such size and nature as to be resistant to the flow of water. Localities where the formation consists of lenses and pockets of materials varying in size and characteristics do not lend themselves readily to such construction. For the purpose of illustrating the effects of materials of different sizes on the character of the hydraulic grade line, two diagrams (Fig. 7) are given showing conditions encountered during the course of studies of materials for the Gatun dam.[1] Similar effects will of course exist where the excavation is through a made embankment above ground or through the earth foundation under a dam.

The principal variables affecting the character and position of the hydraulic grade line are size of particles, porosity, uniformity coefficient, applied head and length of travel. A number of problems present themselves in these diagrams, but the one that seems most pertinent to this discussion is the sharp drop in the hydraulic grade line in dam No. 2 as contrasted with its location in dam No. 1, due to the zone of very fine material deposited near the center of the dam. This indicates the condition that often obtains when a practically impervious cutoff is located at the center of a dam and reaches to bedrock or other fully impervious stratum.

The character of the water flowing in the stream and underground may also have considerable bearing in the type of construction. Decomposition of rocks having considerable amounts of pyrite may produce chemical activity that will cause serious deterioration of concrete. Change of the feldspar content to kaolin in originally deep-buried pegmatite dikes or similar rock may cause structures otherwise stable to slip or be undermined. Silt-bearing rivers or those having frequent floods, similar to the Chagres River at Panama, when impounded soon form a practically impervious seal over a valley bottom and tightly close a foundation layer. Simulation of this natural phenomenon may be used, often with great advantage, to make stable foundations in porous materials that otherwise would cause trouble. By placing a properly compacted material above the dam, water may be compelled to travel so long a distance underground to find an outlet that all its energy is dissipated in friction and the resultant velocity and force too small to cause trouble.

A few examples of foundation failures of dams are given in the accompanying table for the purpose of practical illustration. No references other than the year are given, because in most cases the matter was of sufficient importance to have the details thoroughly set forth in the engineering press and other technical publications at the time of the occurrence and later. The lesson, "so clear that he who runs may read," is, as previously stated, that ignorance, negligence or contempt of principles that should be well known to him who would design a dam have resulted in numerous cases in the loss of many lives and the destruction of much property, and in other cases the repair or reconstruction cost has been very heavy.

[1] See Appendix E, Report of Isthmian Canal Commission, 1908; also "Engineering News," Dec. 24, 1908.

FOUNDATION FAILURES OF VARIOUS TYPES OF DAMS

Name	Year	Cause
Masonry Dams		
Austin, Tex.	1900	Undercutting of limestone layers and slipping of strata, due to interbedded clay seams
Austin, Penn.	1911	Slipping of sandstone layers
U. S. dam 26, Ohio River	1912	Slipping of limestone layers
Reservoir wall, Nashville, Tenn.	1912	Slipping of limestone layers
Reservoir, Johnson City, Tenn.	1913	Settlement of foundation, due to cavity
Earth Dams		
Mill River dam, Mass.	1874	Layer of coarse gravel; core wall not carried to rock
Lynde Brook dam, Mass.	1876	Stratum of porous material under gatehouse
Fergus Falls, Minn.	1909	Percolation under dam
Ansonia, Conn.	1912	Blowout under dam
Cedar River, Wash.	1915	Gravel stratum beneath dam
Zuni dam, N. M.	1909	Undermining due to gravel layer under lava stratum
Horse Creek dam, Colo.	1914	Excessive seepage; cutoff not carried to rock
Hatchtown dam, Utah.	1914	Undermining due to gravel layer under lava stratum
Miscellaneous Types		
Hauser Lake, Mont.	1908	Steel dam. Steel piling partly driven in deep gravel formation; core wall omitted at this section
Ashley dam, Pittsfield, Mass.	1909	Reinforced concrete. Porous layer of gravel; core wall not carried to rock
Stony River dam, W. Va.	1914	Porous layers; core wall not carried to rock

In a report on the character of the rock in the foundations of United States dam No. 26, which failed in 1912, the United States Geological Survey stated:

Shales are in general among the weakest rocks, especially when saturated with water. If it (the sample) is the rock in place and the dam was built directly upon it, petrographic examination suggests no reason why the material should fail unless the rock under the dam is traversed by faults, so that portions of it are crushed and would admit water through open crevices. In that case large portions of kaolinite would form in the rock, and its tendency to split into flakes would constitute important features of structural weakness.

In a discussion of the failure of one of the dams mentioned it is stated that, although a test pit excavated to a depth of 17 ft. disclosed no seams of any character, after the failure "it appears, however, that it (the test pit) just barely missed a loose seam of combined sand, shale, coal, etc., which varied from 10 in. to a pinch-out and is approximately 5 or 6 ft. wide, having such a dip as evidently carried it under the bottom edge of the cutoff wall at that point. The failure of the test pit to disclose this seam is fundamentally at the root of the whole trouble. When the cutoff trench for a distance of 200 ft. at that end was dug in apparently sound hardpan, it passed just over this water-bearing seam, which thus failed to be disclosed at all."

Comment is unnecessary on this and similar conditions elsewhere that are disclosed by study of the references given and other similar occurrences except to reiterate that the examination of the foundation of dams cannot be too thoroughly done and that problems relating to such work may be delegated for solution only to those having experienced judgment in this class of work. Procedure contrary to this is closely allied to contributory criminal negligence.

In commenting on the failure of the earth dam on Mill River, at Williamsburg, Mass., in 1874, the late William E. Worthen said:

Men were employed who were ignorant of the work to be done, and there was nothing like an inspection, although money and life depended on it. I do not believe, however much we are an evolved species, that we are descended from beavers. A man cannot make a dam by instinct or intuition.

Thorough exploration, skilled design, good construction under competent engineering direction and inspection are even more essential today than they were in 1874, and fortunately all are much more readily available now than they were then.

Height of Waves in the Belle Fourche Reservoir

By D. C. Henny*

Engineering literature contains little information regarding the height of waves in reservoirs under various wind velocities. The Stephenson formula is as follows:

$$H = 1.5\sqrt{F} + (2.5 - \sqrt[4]{F})$$

in which H is the height of the wave in feet and F is the fetch in miles.

This formula does not contain any factor for wind velocity and seems irrational because for a value of $F = 0$ the height of the wave would be 2.5 ft.

Some experiments were conducted last year on the Belle Fourche reservoir in South Dakota, of the United States Reclamation Service, by Project Manager B. E. Hayden. A gage was erected well out in the water, and a recording anemometer was installed. The height of waves from crest to trough was observed during various times in 1915 with the following results:

1915	Wind Velocity per Hour, Miles	Height of Waves, Feet
Aug. 28	35	2.0
Sept. 8	40	2.5
July 4	44	2.5
May 16	48	3.5
Oct. 7	50	3.5
June 12	56	4.0
Oct. 24	75	5.0

The water in the reservoir during the entire period stood at from 8 to 5 ft. of full reservoir, and the fetch varied but little from 5 mi.

In plotting the heights of waves as abscissas with the wind velocities as ordinates it is found that a straight line fits all points fairly closely. The formula of this line is

$$H = 0.075\ (V - 8.5)$$

V being the velocity of the wind in miles per hour and H the total height of the wave from crest to trough in feet. With a wind of 8.5 mi., the wave height is practically zero.

Experiments on other Reclamation Service reservoirs will be made to test the general applicability of the preceding formula for a fetch of 5 mi. and to determine the effect of variable fetch. The value of H as derived from the Stephenson formula for a fetch of 5 mi. is 4.35 ft., which is in agreement with the Belle Fourche formula for a wind of 60 mi. per hr.

A Deep-Mine Pumping Plant recently installed in a colliery in North Staffordshire, England, is described in "The Engineer" (London). The plant consists of a seven-stage centrifugal pump, direct connected to a 380-hp. electric motor. The pump is designed to discharge 850 gal. of water per minute against a total head of about 1,100 ft. when running at 1,485 r.p.m. The plant was installed by the Pulsometer Engineering Co., Ltd., of Reading, England, and the pumps are guaranteed to have an efficiency of 74%. In the test of the unit an efficiency of over 79% was attained. Two units of this type have been installed with a third for a standby. The pumps deliver into a steel pipe which extends up the shaft to the surface. The pipe was made up in 40-ft. lengths with spigot and socket joints which were welded by an oxyacetylene torch as fast as the pipe was erected.

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Field and Office

Cable Tramways Used on Construction Work

It is not often that the handling of materials on construction work is effected by means of aërial tramways or cable tramways (as distinguished from single-span cableways). Three installations of this kind were employed on the Los Angeles aqueduct. They were built by the American Steel and Wire Co., of New York. Information has been furnished by the builders and by Roderick Mackay, Chief Mechanical Engineer of the Department of Public Service, Los Angeles, Calif.

The first line was near Tehachapi, Calif., and supplied the municipal cement mill at Monolith with clay from the clay deposit. This was about 6,000 ft. long, with a rise of only 100 ft. between terminals (3,800 ft. and 3,900 ft. elevation). The line was straight between terminals. The load was carried in the ascending direction by buckets making a continuous circuit. In general there were 30 buckets, of 6 to 10 cu.ft. capacity, and the carrying capacity of the line was about 24 tons per hr.

The tramway was of the Trenton-Bleichert type, with about 20 spans averaging 250 to 300 ft. The carrying or track cables were of locked-coil construction, 1⅜-in. diameter on the side of the loaded buckets and 1 in. for the empty buckets. The traction cable was a ⅝-in. endless cable having six strands of seven wires each. Its speed was usually about 300 ft. per min., but at times was over 400 ft. This cable was driven by a 15-hp. motor, using three-phase alternating current at 2,200 volts.

FIG. 1. CABLE TRAMWAY USED IN THE CONSTRUCTION OF THE LOS ANGELES AQUEDUCT

The buckets were arranged for dumping automatically at any point along the line, depositing the clay in a stock pile. After dumping, they continued to the tail terminal, where they passed around a 12-ft. sheave without being detached from the traction rope, so that they required no attention at that point.

At the loading terminal the empty buckets were detached from their hangers and transferred to cars which conveyed them to the clay pit. After being loaded, they were returned to the loading terminal, where they were again attached to the hangers and sent out on the tramway.

All structures were of wood. Some of the towers were single posts with cross-timbers; others were pairs of A-frames braced together. The line crossed the Southern Pacific tracks, and to protect trains from material falling from the buckets a guard bridge was constructed consisting of suspension cables supporting heavy wire netting beneath the tramway.

During the earlier period of operation of the cement mill a steep-grade cable tramway operated by gravity was used to carry rock from the limestone quarry to a railway serving the mill. This was about a mile in length (on the slope), with a fall of 1,050 ft., the terminals being at elevations of 6,100 ft. and 5,050 ft. It was operated by gravity; the speed was about 250 ft. per min. The buckets were of 5 cu.ft. capacity and spaced about 200 ft. apart. The loading and dumping were effected automatically, a charging hopper delivering the load to the bucket. The mill required approximately 300 tons of rock per 24 hr., and the tramway was able to supply this amount with ease. This tramway was installed in the spring of 1909, but was discontinued

owing to the use of a nearer and better supply of limestone.

The third tramway was for a different class of service, as instead of being confined to one kind of material it handled all kinds upward from the railway to the point at which construction work was in progress.

This tramway was at Soda Springs, about 70 mi. north from Mojave, Calif. It was 2,600 ft. long, straight between terminals, with six spans and a maximum span length of 900 ft. The elevations were 2,981 ft. and 3,639 ft. at the lower and upper terminals, giving a lift of 658 ft. The cable took a catenary curve, and the maximum grade was about 40%. Loose materials were carried in automatic dumping buckets of 6 cu.ft. capacity. For carrying other materials, such as pipe and lumber, there were platforms suspended from the carriers. Loads of 900 to 1,000 lb. weight were carried.

The stationary cables were of locked-coil construction, 1⅛-in. diameter for each side of the tramway. The traction cable was ½-in. diameter, of plow-steel wire.

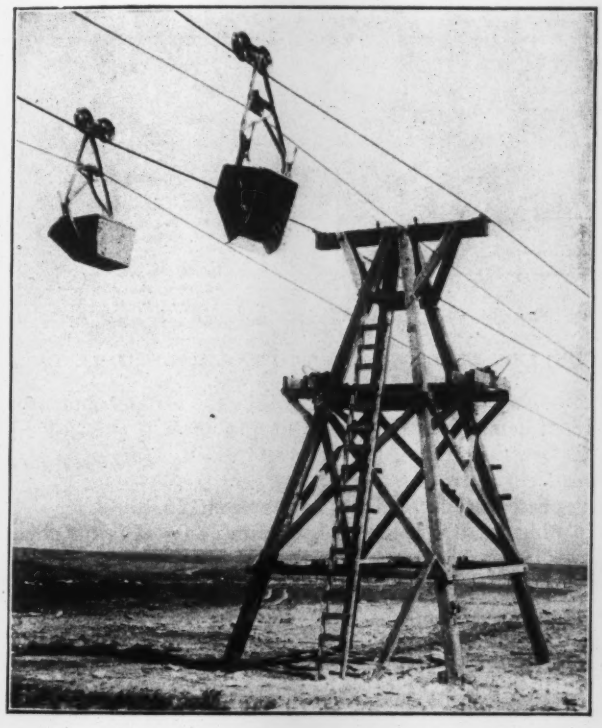


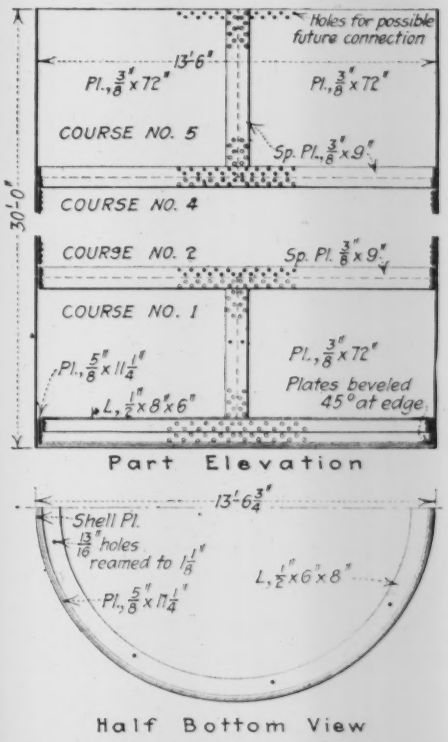
FIG. 2. TOWER ON LOWER END OF TRAMWAY

This was driven at about 250 ft. per min., the driving plant being operated by a 15-hp. 3-phase 440-volt motor. The towers were of wood.

Steel-Lined Shaft in Water-Bearing Sand

The shore shaft for the new Wilson Ave. intake tunnel at Chicago had to be sunk through a water-bearing stratum. For 20 ft. from the surface the material is sand, and 12 to 14 ft. of this carries water. Below this is soft blue clay, which gradually grows harder until the rock surface is reached.

On account of the water-bearing sand it was decided to sink a ⅜-in. steel shell to a seal in the clay so as to prevent leakage into the shaft. The excavation was started with an 18-ft. square set of bracing and sheeting, inside of which the steel shell was started. The shell



STEEL LINING FOR A TUNNEL SHAFT IN WATER-BEARING SAND

was 13½ ft. in diameter and was brought on the job in five 6-ft. sections. These were riveted and calked section by section and sunk into place by digging in the center and loading the shell with 140 tons of pig iron. Octagonal bracing was placed within the shell to insure stiffness.

Below the shell, wood lagging (with steel ring braces) was used to the rock surface. When rock was reached, the shaft was concreted to the top.

Locating Gate Boxes by Compass

By Selden P. Sears*

The use of a magnetic dipping needle for locating covered iron gate boxes, manhole covers, etc., has been successful for several years, but so far as the writer has heard there has not been as much work with a simple compass. A brief note, therefore, on this use of the compass in Hartford, Conn., may not be out of place.

Although the Hartford Water-Works has maintained for the last ten years or more a commendable system of recording the location of all gate boxes, there are times when the engineers have been delayed in getting the field notes owing to the advent of more important matters. In this way it would occasionally happen that, because of excessive backfill or an intervening snow-

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storm, a gate box could not be located without using a pick and shovel. To overcome this difficulty the writer developed a method suggested to him by the use of the dipping needle.

The location of a cast-iron gate box can be easily determined by the compass needle if it is watched carefully and passed within 3 ft. of the box, provided the covering is not over 3 or 4 in. By going over the ground more thoroughly it is possible to get good results when the covering does not exceed 15 in., if there are not too many trolley tracks or heavy electric circuits nearby.

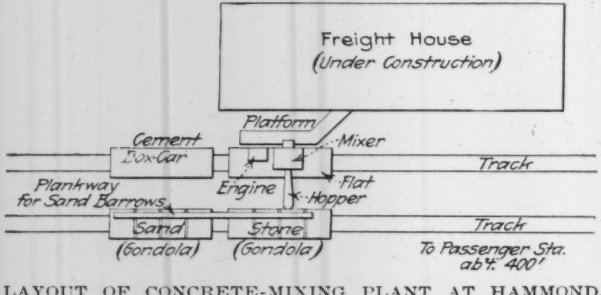
Two searches made by the writer may be cited: (1) A gate located within an hour which two laborers working with pick and shovel for three days had failed to find; (2) a gate box found in two minutes of which only the approximate location was known and which was covered with 1½ in. of asphalt. For this work a 2-in. compass was used costing about $1.50.

It is well to observe the action of the compass around a visible gate box before trying to locate the invisible ones.

Concrete Plant Handled on Four Freight Cars

In the construction of a concrete freight house for the Nickel Plate R.R. at Hammond, Ind., the entire concreting plant was disposed on four freight cars which could be run onto the tracks adjoining the house. By this arrangement the work could go forward without risk or holding up any traffic on the railway. This was important, as Hammond is situated on the main line. The accompanying diagram shows the layout.

A Ransome mixer was mounted on the flatcar on which it was shipped into the yard. After the car had been spotted the mixer was moved over to one side of the car so that the loading hopper would lower onto the side of a steel gondola on an adjoining track. This gondola contained the stone; the sand was in a car attached to the stone car, with a plankway for the sand barrels spanning the two cars. Cement was brought in a box-car run in



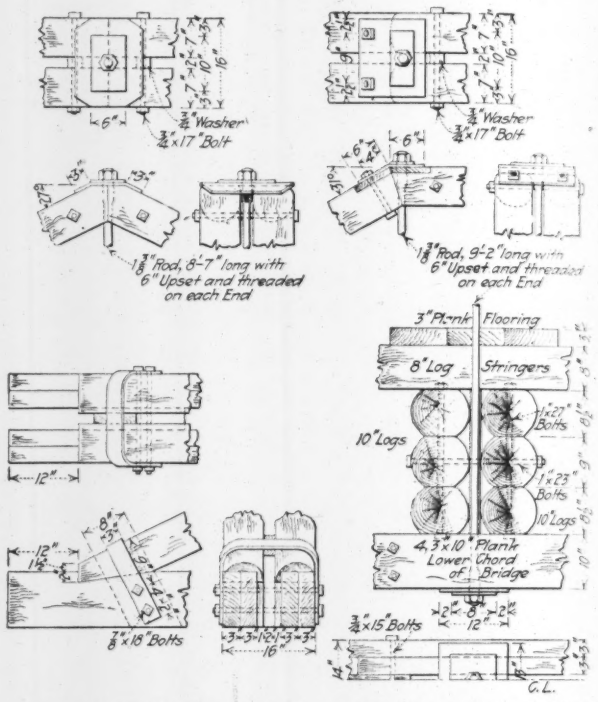
LAYOUT OF CONCRETE-MIXING PLANT AT HAMMOND, IND., FREIGHT HOUSE, NICKEL PLATE R.R.

on the same track carrying the mixer car, and the cement in sacks passed from one car to the other when required. A barrow platform was built on the ground in the inside of the mixer-car track and leading to the structure.

This mixing plant was economical from the labor standpoint. One man in the sand car and two or three in the stone car shoveling directly into the hopper were practically all that were required to get the material to the mixer. Work was done with railroad forces under the direction of E. E. Hart, Chief Engineer of the railroad.

Log Truss Highway Bridges, Utah Road Standards

Log trusses are built frequently enough in Utah road work so that the State Road Commission finds it necessary to have standards for details of such bridges. The drawing herewith reproduces these standard details, which



DETAILS OF LOG TRUSSES, UTAH ROAD COMMISSION

comprise the heel and peak joints and hanger and floorbeam details, for kingpost and queenpost trusses. Hugh C. Lewis is bridge engineer and E. R. Morgan is state road engineer.

These details apply to spans from 20 to 40 ft. The loading for which the bridges were designed is the standard 18-ton road-roller loading of the commission, with 20% additional for impact. The bridges are intended for first-class highway service.

The floor construction became somewhat of a problem on account of the heavy loading. The longest stringer panel is about 12 ft. Using 8-in. logs as stringers, the span requires their being placed as close as possible—about 9 or 10 in. average. The floorbeams, spanning 17 ft. c. to c. of supports, required a depth which had to be obtained by applying the "deepened-beam" idea to log construction. Each floorbeam is made of six 10-in. logs bolted together in three tiers.

The cap-plates or washers of the main truss rods bear on flat seating slabs of wood notched into the chord logs. This is necessary to give proper contact between cap-plate and wood, although the plate is designed of such size as to distribute its pressure over a bearing of common fir.

The log bridges have been used in localities remote from railways where concrete or steel would be extraordinarily expensive, yet where stone for abutments and logs for trusses are handy. The iron parts are so designed that they can be forged on the job.

Capacity of Twin Pipe Line

By Francis H. Kingsbury*

When a new pipe line is laid to parallel an existing one for increasing the capacity, the new line is often to be installed in sections, as funds become available. It then becomes necessary to make a complicated cut-and-try computation to determine the capacity or loss of head of the combination. The following graphical method of solution, using Williams and Hazen's "Hydraulic Tables," eliminates much of this work.

Referring to Fig. 1, suppose the two pipes *AB*, taking a given flow of water at point *A* and delivering it at point *B*, are in one or more lengths of different sizes and different ages. Required, the total head lost between *A* and *B*, and the flow through each pipe.

Prepare for each of the two pipes a table of loss of head for different discharges, plot these values as ordinates on the discharges as abscissas, and find at what ordinate the sum of the abscissas of the two curves equals the given total flow. By plotting one curve to the left of the vertical axis and the other to the right, this operation is very simple, as an example will show.

Assume that the pipe sections have the sizes and ages given in Fig. 1 and that their combined flow from

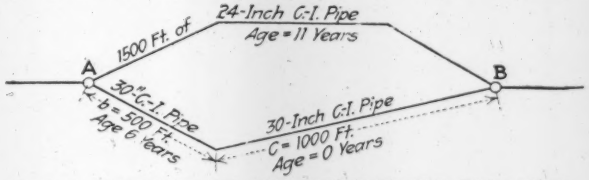


FIG. 1. SKETCH OF COMPOSITE TWIN PIPE-LINE

A to *B* is 8,000,000 gal. per 24 hr. Using the tables, make up the following table of loss of head:

Loss of head = loss in feet per 1,000 ft. × length in feet ÷ 1,000.

Gallons per 24 Hr.	24-In. Pipe Age = 11 Yr.	30-In. Pipe Age = 0 Yr.	30-In. Pipe Age = 6 Yr.
1,000,000	0.060 × 1.5 = 0.090	0.015 × 1 + 0.017 × 0.5 = 0.024	
2,000,000	0.218 × 1.5 = 0.327	0.054 × 1 + 0.062 × 0.5 = 0.085	
3,000,000	0.459 × 1.5 = 0.689	0.113 × 1 + 0.132 × 0.5 = 0.179	
4,000,000	0.780 × 1.5 = 1.170	0.194 × 1 + 0.225 × 0.5 = 0.307	
5,000,000	1.180 × 1.5 = 1.770	0.292 × 1 + 0.340 × 0.5 = 0.462	
6,000,000	1.660 × 1.5 = 2.490	0.410 × 1 + 0.475 × 0.5 = 0.648	

From the table, plot the total head lost, against the quantity of water passing, as in Fig. 2. If the loss of head were given, then the sum of the two abscissas at this ordinate would equal the combined flow. Conversely, if, as in this example, the total quantity of water is given, this quantity may be laid off on the edge of a piece of paper according to the scale of the abscissas, and by moving this scale parallel to the horizontal axis until the sum of abscissas of the two curves equals the given quantity, the actual loss of head is found, and the abscissas of the points of intersection will represent the respective quantities of water flowing in the two pipes. If allowance is to be made for loss at gates and bends in the pipe lines, this loss should be added to the total head lost in friction before plotting.

For the example, the head lost in friction in each line is 0.53 ft. and the quantities of water flowing in the 24-in. pipe and 30-in. pipe are 2,620,000 and 5,380,000 gal. per 24 hr. respectively.

To check the solution compute the head lost by friction in each pipe with the foregoing quantities of water

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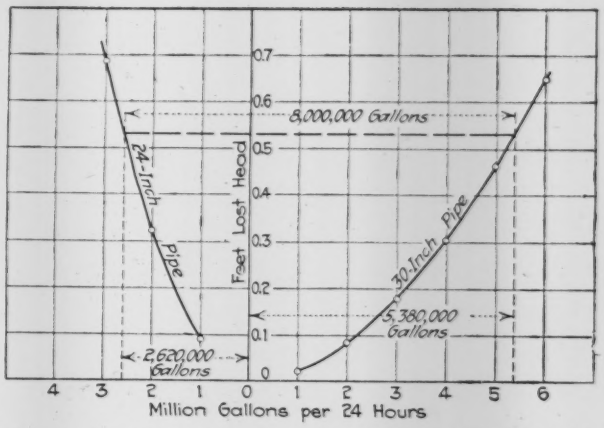


FIG. 2. CURVES OF LOSS OF HEAD, AND METHOD OF READING ACTUAL HEAD LOST

flowing; the results should be equal. For example, from the plot, the quantity flowing in the 24-in. pipe was found to be 2,620,000 gal. per day. From Williams and Hazen's "Hydraulic Tables," by interpolation, the total head lost between *A* and *B* is computed to be 0.539 ft. Similarly, the head lost in the 30-in. line with 5,380,000 gal. flowing is computed to be 0.53 ft. This latter figure equals exactly the lost head as determined by the plot. The former figure varies from the result obtained from the plot by only 1.7%. With a larger scale of plotting, even better results would be obtained.

Cleaning Nashville Reservoir by Hydraulicking

The water-works department of Nashville, Tenn., made a saving of nearly two-thirds in costs and nearly three-fourths in time in cleaning its coagulating and settling reservoir in May, 1916, over the cost and time of the last previous cleaning, which took place in the latter part of 1913. This saving was accomplished by installing an electrically driven centrifugal pump.

The last previous cleaning required about one month and three shifts of 80 men each were used with a total payroll of $4,200. However, one of these shifts was composed of workhouse prisoners, whose labor was not charged against the cost of the work, with the exception of the cost of the overalls purchased for them.

This year the work was started on May 16 and two 10-hr. shifts, of 60 free laborers each, were used for 8½ days, the total payroll being $1,625. The current consumption was 1,500 kw.-hr., costing about $40. The motor, which was a Wagner 35-hp., single-phase motor, cost $500, while the Vance pump, which was direct-connected, cost $225. Even if the entire first cost of the motor and pump were charged against this year's cleaning, which would be unfair, and the cost of current added, there would still be a large saving as compared with last year.

The reservoir is an elliptical structure, the major axis being 603 ft. and the minor axis 463 ft., 4 in. It is divided by a cyclopean masonry wall 30 ft. high into two settling basins, with a holding capacity, when free of sediment, of 25,000,000 gal. each. Owing to the fact that during the cleaning it is necessary to shut off a small section of the city from the treated water-supply,

brick dividing walls have recently been built in each basin. The water is treated with aluminum sulphate and lime.

The depth of sediment in the west basin was 7 ft. and seven days were required for removing this, while the east basin contained 6 in. of mud, having been cleaned more recently.

The pump was suspended by a crane over the raw-water well and drew water to a 6-in. main over the dividing wall. There were connections at every 10 ft. Two lines of fire-hose were used, each with a 2½-in. nozzle, and eight men handled each hose. The other 44 men handled scrapers, built of oak strips to a width of 8 ft., each scraper requiring four men. All material was forced by the combination of scrapers and high-pressure streams, to a sewer.

The mounting of a pump on a crane renders it available for pumping out any of the wells, while the reduction in cleaning costs will enable the city to clean the reservoir every year. Robert Elliott is commissioner of water-works.

NOTES

Highway Bridge Record Plans—Record plans of highway bridges are made up in the State Engineering Department in New Mexico for file upon completion of a bridge, principally to show foundation conditions. Thus, the file sheet for the Rio Grande bridge at Belen, Valencia County, N. M., has at the left a table giving the piledriving data, the four columns of the table giving bent, pile, penetration and time of driving. At the right of the sheet is given a boring record. The price, time of completion and contractor for the bridge are also noted on the sheet. With the generally unsatisfactory foundation conditions in the shifting silt of the river beds in the Southwest, such file sheets are particularly useful. Giving all the necessary information for studying plans for repair or prevention of washouts, they put the department in a position to learn from the record of failure or resistance of a given foundation, to the profit of future bridge work. The State Engineer of New Mexico is James A. French and the Principal Assistant Engineer is Junius W. Johnson.

Weighing Boat Cargoes by Displacement—Supplementing the data given by a note on p. 1050, issue of June 1, 1916, the following notes are contributed by Emile Low, Buffalo: Two hydrostatic locks were built on the Erie Canal about 1825, one at Utica and one at Syracuse, for weighing cargo of canal boats by measuring the displaced water from measurement of depth of water in the lock with the boat, and after draining off the water into a separate chamber measuring the water by its height in this chamber, the boat settling down on timber supports in the lock. In 1828 these locks were replaced by weigh-locks utilizing lever scales. Later, draft gages attached to canal boats were extensively adopted (see also Whitford's "History of New York Canals," Vol 2, p. 1335). Weighing by displacement is much practiced on government contract work. Mr. Low refers specifically to its use on Buffalo harbor excavation some years ago. Draft gages at ends and middle of each boat enabled the mean draft to be observed very easily, and by referring to a table of displacements computed for that boat and subtracting the known displacement empty the cargo weight was obtained. It is possible to graduate the draft gages in tons direct.

Breaking Logs with Dynamite to save a construction trestle over the Grand River at the site of the Grand Valley diversion dam of the United States Reclamation Service is described by O. T. Reedy, Construction Engineer, in the official project history as follows: The pile bridge was constructed for the double purpose of a means of crossing the river during the erection of the main construction plant on the east side and a means for dumping rock and filling material to form the coffer-dam after the high-water season had passed. The bents consisted of three piles 8x14 in. cross-braced and with 10x10-in. caps. The bents were 16 ft. apart; the stringers were 4x12 in. Oregon fir. Before this structure was commenced a good many rivermen, including contractors who had worked on the river before, pronounced it impossible to drive piles in this river with satisfactory results. The superintendent of construction thought otherwise. After the trestle was completed the rivermen announced that almost any medium high water would carry it out. The principal trouble proved to be driftwood. As the bents were only 16 ft. apart and a good many trees as much as 3 ft. in diameter and 50 to 60 ft. long came down the river, the task of clearing this was difficult. Occasionally large trees would lodge crosswise in front of the trestle bents and it was necessary to dynamite them. This was done by wrapping two to ten sticks of dynamite with electric detonator in a small sack fastened to a rope, weighting the sack with gravel, and throwing it above the log, the end of the rope being fastened to the bridge, and exploding the charge. The length of the rope was made such that the sack of dynamite would be carried under and a little down stream from the log. Then the wires of the detonator were attached to a blasting battery a safe distance away and the charge exploded. The superintendent was generally able to judge the size of the charge so as to break the log at the proper point and allow the ends to swing around and pass through between the trestle bents. Sometimes several shots were required. In this manner the trestle was protected during an extreme flood, and only one bent was damaged in the shooting operations. Loaded cars were also pushed on the trestle at threatened points.

Counterweighted Check Valves for Pumping Engines—In a large pumping station where some of the units are shut down a considerable loss which would be charged to slippage may result from backflow through the idle pumps. To eliminate this loss in a pumping engine installed at Peoria, Ill., a special arrangement of check valves on the discharge pipe was recently introduced by D. H. Maury, of Chicago, consulting engineer for the Peoria Water Co. The ordinary experience with check valves on the discharge side is that when one pump is shut down and others are discharging into the same outlet these valves are likely to cause vibration, pounding and perhaps water-hammer. Another cause of trouble is that the attendants may not open and close ordinary gate valves every time a pump is shut down, as they should do. To overcome these difficulties, Mr. Maury installed counterweighted check valves, which are swung open or closed with very slight effort when a given pump is put in operation or shut down. The construction of the valve and of its counterweight tends to hold the valve away from its seat while the pump is in operation and thus prevents pounding. When the pump is shut down, the valve can be closed easily by means of the lever carrying the counterweight, and in the closed position the counterweight holds the valve more firmly to its seat.

Approximate Formula for a Spherical Part-Segment—The discussion of the sphere-segment problem in "Engineering News," Mar. 16, 1915, p. 518, is supplemented by an interesting formula devised by Ewald Schmitt, Washington, D. C. It is claimed to be applicable to all part-segments having a rise not more than one-sixth the diameter of the sphere. Using the notation of the prior article (Fig. 1) and calling r the radius of the base-circle of the segment, so that $a + L = r$, the formula is:

$$V = \frac{\pi}{6}(R - b^2)(2R + b)\frac{L^2}{r^2}$$

The practical range of the formula is limited to values of b exceeding ⅛ R and to values of L less than r.

Measuring Railway Curves on the Arc—Would it not be more proper and equally as simple, in connection with railroad-curve calculations, to consider the length on the arc instead of on chords of 100 ft.? That is to say: Accepting the circle which measures 36,000 ft. around the circumference as being a 1° curve, whose radius is $\left(\frac{\text{cir.}}{2\pi}\right) = 5{,}729.58$ ft.; to find the radius of any other curve, divide the radius of a 1° curve by the degree of curve which is to be used. When staking the curve on the ground, use such chords as will subtend 100 ft. of arc. Such chords would be $2R \sin ½D$. In other words, why should we be so particular in measuring a tangent, employing every precaution to ascertain the correct distance between curves, then with a clear conscience lose 0.73 ft. in distance on the center line in going around a 1° curve for 60° of central angle? For more than two years I have been using the above method with gratification and find that a great many of my associates favor the method; however, I will appreciate having the views of other readers.—Theron A. Palmer, Dallas, Tex.

Editorials

Society of Civil Engineers Votes for Co-operation

As announced at the annual convention of the American Society of Civil Engineers this week at Pittsburgh, the letter ballot vote in the society on the question of removing from the society's old house in New York City and joining with the other three great national societies in the ownership and occupancy of the Engineering Societies' Building on 39th St., has been overwhelmingly in favor of the proposition. There were more than six votes in favor of the proposition for every vote cast against it.

The society and the profession is to be heartily congratulated upon this result. It indicates a clear understanding on the part of the membership of the present-day situation in the engineering profession. It would not have been at all strange had a much larger vote in opposition been registered, for it was difficult, unquestionably, for the members of the society in remote parts of the country, to obtain a clear idea of the situation in New York City and understand why it was advantageous for the society to give up its own separate house and undertake coöperation with the other national societies in the control of national headquarters.

Now that the coöperation is decided upon, the next step will be the planning and arrangement of the new headquarters in the Societies' Building. As has already been pointed out in these columns, it is extremely desirable that these new headquarters shall be so planned that they will be an attractive social resort for the members resident in New York and for out-of-town members visiting the city, as well as a set of offices for the society's working force. If this work is well done, membership in the American Society of Civil Engineers will be more attractive than ever before.

Assuming Contractors Honest

It is very common in drawing contract specifications for engineering work to insert a clause to the effect that the contractor shall examine the plans for errors and omissions, and that the engineer washes his hands of all responsibility for such errors or omissions as may be found. In the same document the whole intent and purpose is to bind the contractor for all errors, blunders or omissions *he* may make.

This harks back to the time-honored assumption that the contractor is a buccaneer, ready to take every unfair advantage. Why should the contractor be asked to correct the engineer's plans and assume the responsibility for errors and omissions if there are any?

Since no human being is infallible, it is necessary to recognize the liability of error in the plans. Yet this may be done in a gentlemanly way without specifically inferring that the contractor is the only one who would take advantage of the discrepancies. It may be done on the assumption that both contractor and engineer are honest and honorable in their dealings with each other. As an example, the following clauses from the specifications for paving a $1,500,000-road system in Vermilion County, Illinois (P. C. McArdle, Superintending Engineer), are interesting:

> The plans and specifications will be held to cover any and all work that could reasonably be inferred as needed for a complete and workmanlike job. It is also understood that no advantage will be taken of discrepancies found in any drawing or specification.
>
> . . . . . .
>
> The plans and specifications show in detail the work to be performed, and each bidder must satisfy himself as to the quantities of materials and work necessary to finish the proposed construction as contemplated by the plans and specifications.

The statement that no advantage will be taken of discrepancies is obviously as binding on the engineer as on the contractor, and it is based on the fundamental assumption that the contractor is as honest a man as the engineer—an assumption which, if generally acceded to, would work wonders in avoiding much of the friction so common on construction work.

Laws to Limit the Length of Railway Trains

During the winter and spring of 1914-15 the railway labor unions caused the introduction in the legislatures of twenty different states of bills to limit the length of railway trains. All of these bills failed of passage, however, and the only state in which such regulation is in force is Arizona, which has a law limiting the length of freight trains to 70 cars.

The Bureau of Railway Economics of Washington, D. C., has just issued a bulletin entitled "Arguments For and Against Limitation of Length of Freight Trains." It contains a careful study of official statistics to determine what, if any, ground exists for the claim that legislation is necessary to limit the length of freight trains in the interest of public safety.

As all engineers who are familiar with railway operations are aware, nearly all the improvement in economic freight handling that has taken place during the past four years has been directed toward increasing the size of the freight-train load. The vast sums expended for grade reduction, heavier rolling stock, heavier bridges, and many other improvements have all had for their chief object the increase of the freight-train load for the purpose of reducing the total cost of haulage. The necessity of such reduction in cost to enable the railways to remain solvent while faced with reduced earnings per ton-mile on the one hand, and increased wages and higher prices for materials on the other need only be referred to. It will be admitted, however, that if the extraordinarily long freight trains now being run cause undue danger to employees or to the traveling public, a reason might exist for their limitation.

The subject is fully discussed in this pamphlet, and it is shown that nearly all railway casualties are closely

proportionate to the number of trains operated. It will be obvious that a railway must carry all the traffic that is offered to it, at least up to the limit of its capacity; and that if it is prevented by law from running very long trains, then it must run a greater number of trains. It is well known, furthermore, that the risk of accident in train operation rapidly increases with the density in train movement. The railway companies affected by maximum train length legislation would be the roads of heaviest traffic which, if they were prevented from running very long trains would have to run a greater number of trains. These would have to be crowded closer together on the schedule with consequent greater liability to accident.

The statistics indicate that there would have been a considerable increase in railway casualties during the past ten years, except that the growth in traffic has been about offset by the increase in size of trains. In the ten years from 1904 to 1914 density of railway freight traffic in the United States increased 36%, measured in the ton-miles of freight carried per mile of line. This increase was more than taken care of, however, by the increase in freight-train length and loading so that the freight-train mileage per mile of line decreased 3.8%.

So much for the demonstration that legislation to limit the length of railway trains is legislation to increase instead of to decrease the danger in railway service. It is of interest to note also the financial effects of such legislation. In 1915 when a bill limiting the length of freight trains to 50 cars was pending in the Legislature of Illinois, 23 railway companies of that state owning a little less than 9,000 miles of railway, made an estimate of the effect such legislation would have on their investments and operating expenses. This estimate showed that over $45,000,000 which these companies had invested in grade reduction and heavy rails, in siding and terminal track extensions, and in heavy locomotives would be made valueless. On the other hand, they would have had to invest about $12,000,000 in additional locomotives, locomotive terminal facilities, and passing and terminal tracks, and in ten years to come would have had to invest over $43,000,000 in adding second, third, and fourth tracks to take care of the additional number of trains. Besides this, the companies would be subjected to an increase in annual operating expenses of over $4,000,000, made up of additions to the payroll and increased cost of fuel.

There could hardly be a better illustration of the danger to the public welfare involved in such attempts at legislative regulation of railway affairs as has become unfortunately too common. There is one aspect of such legislation which deserves consideration since it illustrates how serious the action taken by a single state might be in interference with interstate commerce. Suppose the small State of New Jersey, for example, were to enact a law fixing the maximum length of railway trains that might be operated within its borders at 50 cars. All the trunk line railways which run across New Jersey to reach tidewater at New York City would be affected by such a law and would be compelled to split up trains, alter division points and go to enormous expense. Since there is no margin of profit in railway business sufficient to take care of such an outlay, the inevitable result would be an increase in freight rates which would be distributed to a greater or less extent all over the country.

The obvious purpose back of this proposed legislation, like the purpose back of the full-crew laws, is to create more situations for railway trainmen, or in other words compel the employment of a larger number of men to perform a given amount of work. Unfortunately, these maximum train laws do not merely take a dollar out of the railway treasury and put it in the pocket of a workman, but they would compel the railways to waste five to ten dollars for every one which they would pay out in increased wages.

Port Data Brought Together

Governmental reports are proverbially dry and uninteresting, however commendable may be their intent and thorough their execution. Once in a while there appears one which, admirable in itself, acquires a special significance because of the mediocrity of its fellows. Such a report is the one just issued by the Bureau of Foreign and Domestic Commerce under the title "Ports of the United States" and the subtitular description "a report on terminal facilities, commerce, port charges and administration at 68 selected ports."

In this volume, a bulky document of 431 pages and 21 inserted maps, the author, Grosvenor M. Jones, Commercial Agent of the United States Department of Commerce, has brought together the most valuable information on all the ports of the country doing a business in excess of $30,000,000 or 1,000,000 short tons a year. This information comprises a description of the physical features of the port, in the more important cases accompanied by maps, a statement of the railway and steamship services, recent statistics of the business done, tabulation of the ownership of waterfront and details of port administration and charges. This, it will be seen, is the kind of data which has been sought by many engineers for a number of years, and it is the kind which only a Federal bureau can well compile. The department and its agent are to be congratulated on the efficiency with which the work has been accomplished.

Copies of the report may be procured from the Superintendent of Documents at Washington, D. C., for 75c.

Waste Disposal Rightly Placed

Placing everything pertaining to the collection and disposal of garbage and other refuse at Chicago in the Bureau of Waste Disposal, headed by a competent engineer, instead of having the work divided between the Departments of Health and Public Works, is a most commendable move. Heretofore in most of our cities the collection and disposal of the various classes of municipal waste have been conducted in a hit-and-miss fashion instead of being placed under competent engineering supervision, where they belong. The common neglect of waste collection and disposal in the majority of cities and a misconception of the relation of this service to public health have combined in many instances to put the service in charge of the health department. Both by function and personnel, health departments are rarely competent to handle waste collection and disposal, which are essentially engineering problems and which have far less direct relation to health than was formerly supposed. The misplacing of this service has diverted the energy and funds of health departments from far more directly

health-protective work and has also resulted in inefficient methods and unnecessarily high costs. The most progressive health departments throughout the country now recognize pretty generally that waste collection and disposal do not naturally fall to their lot. The sooner all health departments recognize this fact the better it will be for public health and municipal economy.

The Mississippi Levee System Sustained by the Courts

An important court decision was recently rendered in Mississippi, where certain landowners sought to enjoin the United States Government from building levees along the Mississippi River and the court refused the injunction. To engineers generally it may seem very strange that such a suit should be brought. The explanation is that there has long been a conflict of public opinion regarding the levee system in the sections of the Mississippi delta protected by levees. The majority of intelligent public opinion without doubt supports the policy recommended by practically all competent engineers who have given thorough study to the question and understands that the levee system is the only means by which the lands along the river can be given protection from floods. There has always been, however, a noisy minority which has opposed levees on the ground that the confining of the water by such means would make the floods rise higher and higher, both because the spread of the floods over the bottom lands is prevented and because of the claim that the bed of the river is continually being built up by deposits of sediment.

It has been easy to secure considerable popular support for this theory, because the residents along the river have themselves witnessed the high-water mark of the floods rise higher year by year as the levee system has been extended.

Of course, this effect was expected and predicted by the engineers. It has repeatedly been shown, moreover, that the most careful investigations have not revealed any general rising of the bed of the river. On the contrary, as far as any change can be determined in the river bed, as a result of the confining of the flood waters by levees, the tendency is toward deepening rather than shoaling.

It can readily be understood, however, that these thorough scientific investigations by the Mississippi River Commission are of little weight with many a man, compared with the evidence his own eyes give him of the steady increase in flood heights. It is not strange, therefore, that there should be a vociferous minority in the Mississippi delta to oppose the levee system. This minority finds representation in certain Southern newspapers and, as previously stated, has carried its opposition into the courts.

It will be obvious that, if the courts had decided in favor of this minority, it would have put an entire stop to levee construction along the Mississippi and would have laid a foundation for damage suits, on the part of owners of lands injured by crevasses, against the authorities who have constructed the levee system.

This court decision is of especial interest at the present time when the Federal flood-control bill, which lays down a definite policy for the completion of the Mississippi River levee system by joint contributions of the Federal Government and private landowners, is pending in Congress. Certain newspapers in other parts of the country have been misled by the vociferous minority in the South which has opposed levees. The *Chicago Tribune*, for example, recently attacked the Humphreys flood-control bill in the following terms:

> There are many Southerners and among them owners of land which is overflowed year after year who know that the flood-control bill is a dishonest bill and know from experience that the $45,000,000 Mr. Humphreys wants to spend on levees will be wasted. They know that every time another levee is built the river becomes more dangerous, because its channel is made narrower and more confined. They attribute the apparent aggravation of the floods as much to levees as to the drainage development in the Northern states.

It is a thousand pities that such a great and influential public journal should lend its influence to the support of quack opinions on engineering questions which are so closely concerned with the national welfare. The *Tribune* in order to obtain correct information need do no more than review the masterly debates in the House of Representatives, where Congressman Humphreys and other supporters of the flood-control bill set forth the engineering authority in support of the levee system and showed conclusively that the levee system is not only the best way, but the only way whereby, within practicable financial limits, the 16,000,000 acres of land in the Mississippi delta may be given protection from floods.

Inventories and Histories

While the slow process of mapping and measuring the railways is going forward, the main data of the construction history of our two-hundred-odd thousand miles of track are being gathered. These data were gradually being lost, up to the time the Federal Valuation Board started its work. But railway officials themselves did not realize how little they knew of their property. Not until they set their own valuation men to looking up the records, marking out the property, and measuring track and earthwork, did they discover their lack of even the fundamental items of a simple inventory.

There are many miles of abandoned railway roadbed, or the site of former roadbed, alongside the present track of our more prosperous railways. Dozens of relocations have been made for grade-reduction or change of curvature. The future student of railway-location economics will have to take account of these changes if he wants to deduce sound principles of location or relocation. The questions of cost and value that are fundamental to all consideration of railway finance or regulation must take account of these same changes, and as well of the vast amounts of maintenance expenditure that have been incorporated in the roadbed for replacing dirt and ballast which sank out of sight regardless of theoretical cross-sections.

To make the facts revealed by the railway inventories available for future use requires in effect the compilation of detailed construction histories of the various roads. Now that the forgotten and partly lost data of these histories are in course of recovery, it is well to think of compiling them in lasting accessible form. It is hardly open to question that the future will find much instruction in these histories, and will make them do valuable service. They will amply repay the trifling expense of their compilation.

Letters to the Editor

Pittsburgh Flat-Slab Ruling and the Seattle Test

Sir—In your issue of May 11, 1916, p. 910, John A. Ferguson gives the ruling on flat-slabs which he applied when he was engineer of Pittsburgh's Bureau of Building Inspection and which he proposes to recommend for the new building code of that city. It is significant that a test has just recently been made on a flat-slab building that failed when a trifle more than the design load was placed upon it and that satisfied Mr. Ferguson's ruling exactly, so far as I can interpret it at least. Furthermore, indications were that results would have been worse, if only the load had been placed on the outside panels with the interior panels unloaded.

This building, located in Seattle (*Engineering News*, May 25, p. 992), did not collapse but cracked badly and showed unit stresses in the steel as high as 44,000 lb. per sq.in. and in the concrete as high as 2,930 lb. per sq.in., and also a permanent set. This was under static load applied once. Repetition of the load would doubtless have produced results similar to those in a large building of similar design that had to be abandoned because the floors had sagged as much as 3 in. and bad cracks showed up in every direction. I do not know what this building was designed for, but it figures out 160 lb. per sq.ft. on Mr. Ferguson's standard.

It is well for people to know just what they are getting. If the first disinterested test on a flat-slab building shows failure, the second and all other buildings made on the same standard are apt to do the same, unless we can be convinced that Poisson's ratio and "bond-shear" were merely off the job or had not worked so far west as the Pacific slope.

It is instructive to compare this flat-slab ruling with the requirements for beam-and-slab design in the Pittsburgh Building Code. For the positive moment Mr. Ferguson gives 0.0625 W L in a square surrounding the column head. Half of the rods cut are at 45° and therefore good for seven-tenths of their area, total 85%, or 0.0531 W L.

The code requires that ordinary beams and slabs be designed for 0.083 W L. In the square surrounding a column head the girder would be cut twice and the slab would be cut twice, making the total moment-resisting value in this section 4×0.083 W L or 0.333 W L. The beam-and-slab design must thus be more than six times as strong as the flat-slab design. Tension in concrete has to take up the difference.

This is some difference, but if people want this sort of structure, let them have it; only, they ought to know what the solitary disinterested test shows and how the two standards compare theoretically, and why the beam-and-slab design is penalized.

EDWARD GODFREY.

Monongahela Bank Bldg., Pittsburgh, Penn.,
June 1, 1916.

[This letter was submitted to Mr. Ferguson and he has replied as follows—Editor.]

Sir—Mr. Godfrey has not interpreted the Pittsburgh ruling on flat-slab construction correctly, inasmuch as the design loading was 500 lb. per sq.ft. live and the Seattle floor would be good for only 110 lb. per sq.ft., according to the ruling, using the floor as designed, not as built.

There is given herewith a table showing the stresses computed according to the Pittsburgh ruling, using the floor as designed and also, for the sake of comparison, three sets of stresses from the report of the test.

COMPARISON OF STRESSES IN BELL ST. WAREHOUSE, SEATTLE*
(Stresses in pounds per square inch)

Location	Kind	Pittsburgh Ruling as Designed, 500 Lb. per Sq.In.	Average Stress as Measured	Maximum Stress as Measured	Minimum Stress as Measured
			700 Lb. per Sq.In.		
Interior column.	Concrete	1,680	2,240	2,650	1,828
	Steel	30,000	27,500	30,100	17,700
Exterior column.	Concrete	2,016	2,005	2,930	1,085
	Steel	36,000	32,400	46,000	27,000
Center of span, interior	Concrete	600	875	1,050	700
	Steel	16,600	17,200	18,550	16,450
Center of span, exterior	Concrete	720	1,620	1,950	1,290
	Steel	20,000	37,000	41,500	32,250

*The allowable stresses according to the Pittsburgh Reinforced-Concrete Code are 16,000 lb. per sq.in. for steel and 650 lb. for the concrete.

It will be evident that the Seattle building would not have passed the Pittsburgh ruling even considering that the construction would be in every respect according to the design. Had the steel in the Seattle building been in the position intended, undoubtedly the measured stresses would have been less than those reported and somewhat nearer to those resulting from the application of the Pittsburgh ruling.

The following computations have been made in order to show how closely the stresses computed by the Pittsburgh ruling compare with the actual measured stresses, assuming the steel to be in the position in which it was actually found to be.

	Lb. per Sq.In.
Interior column:	
Concrete	3,340
Steel	53,700
Exterior column:	
Concrete	4,008
Steel	64,440

These computed stresses may be compared with the stress reported in a paper by Mr. Hooker, Assistant Superintendent of Buildings of Seattle, before the Pacific Northwest Society of Engineers, of 50,800 lb. per sq.in. for the steel in the bands at an exterior column and would seem to indicate that the ruling is conservative.

In order to explain the effect of the Pittsburgh ruling on the design, the depth of a drop panel necessary in order for the design to comply with the ruling was calculated for the slab at the column and found to require a total depth of 20 in., while the depth of the slab as designed was 10¾ in.

I am at a loss to understand Mr. Godfrey's remarks in the fourth and fifth paragraphs. His statement of the moment coefficients of the flat-slab ruling is incomplete

and his deductions from those given in the code for ordinary beams and slabs incorrect as a comparison. The ruling gives for the negative moment at the column cap 0.091 W L; for positive moment at the center of the span 0.0625 W L. Adding these together gives 0.1535 W L. Since these moments are given for a circle around the column and concentric therewith, the rods are all cut nearly at 90° and not at 45°, as Mr. Godfrey says. Thus the total moment-resisting value in this section is 0.1535 W L instead of 0.0531, as given in his letter. In the fifth paragraph Mr. Godfrey has forgotten that in the beam and slab construction half the rods cut by a square surrounding the column head are at 90° and therefore good for nothing in moment-resisting value; nearly all the rods react upon the beam and not the column. The value in this section is then 2×0.083 W L or 0.166 W L, comparing closely with the foregoing value of 0.1535 W L for flat slab according to the ruling, instead of the erroneous values of 0.333 W L given by Mr. Godfrey.

JOHN A. FERGUSON,
Secretary-Engineer, Pittsburgh Building Code Committee.

Pittsburgh, Penn., June 22, 1916.

Unethical Competition for Engineering Work

Sir—An editorial in *Engineering News* of Apr. 27, entitled "Coöperation, But to What End?" remarked that "The high-motived gathering of engineers at Chicago known as the Conference on Coöperation met for the broad purpose of securing coöperation—and nothing more." It appears also that no definite action was taken by that conference, because there was no well-defined object before the meeting, and a degree of nebulosity pervaded the minds of those present touching the purpose for which these engineers were assembled.

The writer wishes to suggest a line of coöperation among honorable members of the American Society of Civil Engineers which promises fruitful results and aims to arrest a great and growing evil that now besets the profession.

The title "Member of the American Society of Civil Engineers" has in the past carried with it, and should now carry with it, a valid credential of honorable character. But the system by which applicants are admitted to membership has acted as a dragnet to embrace "all sorts and conditions of men," so to speak, including a large number of members who are wholly devoid of those qualities that are generally recognized as characterizing honorable members of the profession.

In times past we as a profession have enjoyed the distinction of occupying a high plane of professional ethics and a character of rigid honesty that could not be impugned. The title Civil Engineer has carried with it assurance of honorable and incorruptible character. It is feared that this distinction is rapidly being lost.

The writer is not informed to what extent standards of ethical conduct are being maintained by engineers in other parts of the United States, but in this region there is abundant evidence to sustain the foregoing declaration, indicating the woeful degradation into which the profession has fallen.

It has come to be the general practice among a large number of engineers who are members of the American society to throw all idea of professional ethics to the wind and to descend to the lowest plane of disgraceful scrambling for "jobs," not hesitating to elbow out of their way engineers who may have won prior claims to any particular "jobs" and not scrupling at any sort of unfair or dishonest means to "get there."

This evil has grown to such proportions in this territory that it is driving out of the field the men who are not willing, and who indeed are incapable, of adopting the methods of the "get there" element in order to enter into competition with them.

It seems a hopeless task at this late day to undertake to purify the membership of the American Society of Civil Engineers by attempting to weed out the unworthy, and there appears to be no provision in the constitution of the society for applying any process to such an object. The suggestion is here offered, however, that an organization within the society to promote coöperation among its members may find a tangible object and a fruitful field of effort along the lines alluded to.

The idea of the writer may be presented in this concrete form: That a suborganization within the society might be formed by the voluntary enlistment therein of honorable members, which should lay down a code of ethics to be observed by all members of the society in good standing; and that all of the "baser sort" who refuse or fail to recognize and observe such code shall be anathema and shall be ostracized and categoried as pariahs.

If this idea should take form and develop along the lines suggested, there might be evolved a "high court" in which to try offenders against the established code and mete out to those who deserve it such moral and professional punishment as lies within the power of the court to inflict.

Clarksdale, Miss., June 14, 1916. T. G. DABNEY.

What Load to Spandrel Beams in Flat-Slab Floors

Sir—In the design of flat-slab construction it has recently come to the writer's notice that flat slabs as designed in accordance with the Chicago Ordinance, or, at least as interpreted from the Chicago Ordinance, are weak in at least one particular.

It is the custom and requirement in flat-slab design in Minneapolis to figure one-quarter of the panel-load as being transferred and carried by the spandrel beams in square panels; while spandrel beams designed in accordance with the Chicago flat-slab ruling are not figured for any part of the panel load. One-quarter of the panel-load is in all probability greater than the actual amount of the load carried by the spandrel. It is however a safe requirement and leaves no question as to the safety of this part of the construction.

On the other hand, when spandrels are figured only to carry the brick load, and a large part of this brick load is figured as arched, it seems to the writer that serious results are bound to develop where slabs are loaded to their full capacity.

The purpose of this article is to draw out discussion that may correct this one defect in flat-slab design, as it is at present being maintained. W. E. LORD.

1302 Merchants National Bank Building,
St. Paul, Minn., June 20, 1916.

Improving Engineering Education

SYNOPSIS—At the recent annual meeting of the Society for the Promotion of Engineering Education, C. R. Mann, of the Carnegie Foundation, made an address on the faults of present-day engineering education, as disclosed by the studies of a joint committee of engineering societies, and the remedies that suggested themselves.

The most detailed report yet given of the studies of C. R. Mann, of the Carnegie Foundation and the Joint Committee of Engineering Societies, into the improvement of American engineering education, was presented at the twenty-fourth annual meeting of the Society for the Promotion of Engineering Education. Professor Mann's address probably indicated the trend of his formal report to be published in the near future. The discussion was lively and protracted but not hostile to his facts and conclusions.

He first sketched the development of American public educational systems to show how had come about the separation of training in the "useful" arts and sciences as contrasted with more "humanitarian" instruction. He showed that the universal demand for vocational education was changing the public school situation and should result in greater immediate benefit to the mass of students—the only justifiable use of tax-supported schools.

Modern technical schools were described as not having been established like law and medical schools, as the development of apprentice training, but by college professors in an endeavor to meet the demands of the times. But the engineering schools had been kept apart from the arts colleges and the students even treated as of different caste. The achievements of engineering had forced a recognition of the essential nature of practical arts. There still remained to be recognized, however, the essential nature of what might be called human engineering, something which the engineering schools must eventually take up—the organization and control of men and wealth.

A study of the records of American engineering schools showed that practically 50% of the students had barely passed in such fundamental subjects as physics, mechanics and calculus—a condition which indicated some deep-seated faults.

In the first place it appeared that students were given to "soldiering"—much as did men in the industries. In the latter case so-called scientific management had led to careful fixing of the tasks which might be expected. In engineering school courses the tasks needed to be scientifically set to meet the student's ability, environment, and the subject taught. Instead of pass marks there would better be a grading of students according to the severity of tasks which could be accomplished. All this necessitated constant study of students by instructors, and close coöperation between all instructors in checking up the grading of subjects. Progress demanded the abandonment of certain academic ideals now tenaciously adhered to—for instance, the idea of autonomous departments in the engineering schools. The men in one technical branch or department should scrutinize the tasks and instruction in another department. How this could be done and the benefits secured could be seen, for example, at the University of Cincinnati where there was a very complete coöperation between departments, the entire faculty fixing the instruction in all departments.

The low standing of students in physics, mechanics, and calculus leads to a second hypothesis that the students do not understand the work in those fundamental subjects. This may be due to too many problems of Archimedean type—too few of obvious application to common-place matters. The ionic theory is presented before freshmen get the common facts of physical and chemical science—under which conditions they cannot absorb abstract ideas. Too much of the work in general is given in too abstract a way and the tasks are not set after a scientific determination of what the student can really do.

A third hypothesis is possible—that the instructors and professors do not understand the science of teaching. In the investigations of the Carnegie Foundation, some questions were first asked on pedagogical matters, but the pursuit of this line had to be given up because too few understood even the terms of pedagogy. There was to be seen very little study by engineering instructors of the science of education.

The teachers of most technical subjects are better instructors than those of the more abstract subjects, and this results because the men are in closer touch with practical matters that appeal to the student. In Seattle the teaching of mechanics has been made possible in the freshman year without calculus, the work being approached by a series of practical projects or problems.

Results were presented of Professor Mann's second questionnaire as to the relative importance of the various characteristics which an engineer should display. Results of this and the first questionnaire are shown up by the following tabulation:

	Second		First	
Character	24.0		41.0	
Judgment	19.5		17.5	
Efficiency	16.5		14.5	
Understanding of men	15.0		14.0	
		75.0		87
Knowledge of fundamentals	15.0		7.0	
Technique	10.0		6.0	
		25.0		13
		100		100

In all 6,773 votes had been received, of which 6,069 had been counted up to May 1. The relative importance of the groups of qualities was computed from the votes by the method described in Thorndike's "Theory of Mental and Social Measurements." Character was rated higher than judgment by 84.8% of men having less than 10 years' experience, and by 86.3% of men having 10 to 19 years' experience.

Professor Mann contended that better teaching of the subjects rated by the voters as of 25% importance will give the improvement and development in the characteristics rated as having 75% importance.

In the discussion, Dean W. M. Thornton (University of Virginia), W. T. Magruder (Ohio State University), C. S. Howe (Case School), D. C. Jackson (Massachusetts Institute of Technology), A. L. Rohrer (General Electric Co.), C. M. Dooley (Westinghouse companies), among others, agreed that very few failures of men in school or outside were due to failures in technology; most were due to miscellaneous defects of character. There was universal agreement that considerable influence

could be made over character of students in school, but there was not agreement that it could be completely molded.

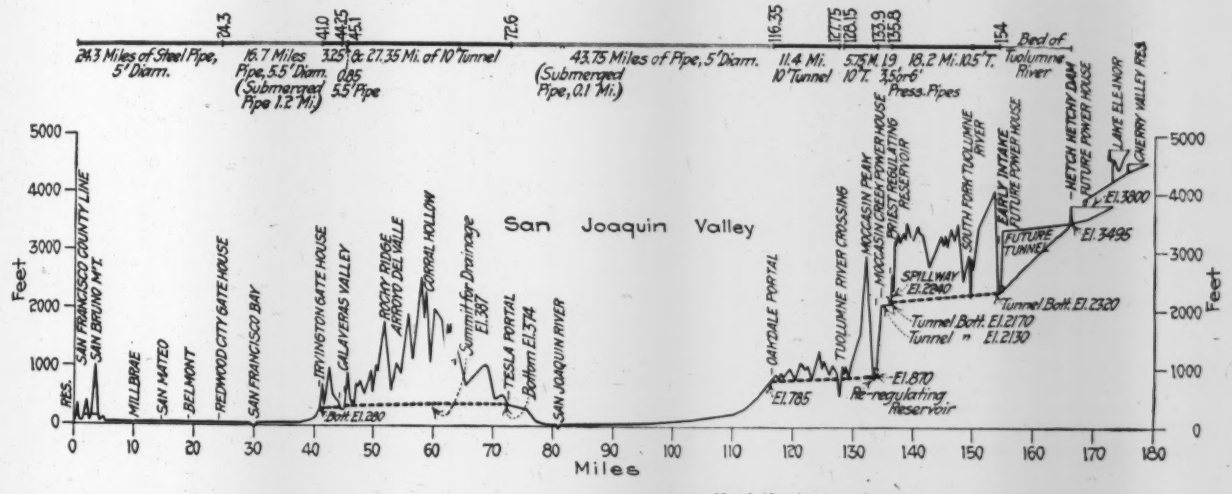
In closing the discussion Professor Mann stated that it was a very complicated subject, in which all the points were very apt to be misunderstood. He thought that all would agree, however, that the engineers' opinions of what the schools should prepare their students for showed that there were other things needed than mere knowledge. The engineering schools were not giving the other things. Good teaching in engineering schools was much more difficult than in art, law, or medicine, because of the inherent difficulty of mastering matter compared with exploiting mind. The capture of matter was absorbing and led to forgetting the phase of character development. There was an insistent demand for more cultured engineers. The problem was to reunite the mastery of matter and the earning of a living with more culture.

Hetch Hetchy Water Program, San Francisco, Calif.

The latest revised profile for the new gravity water-supply from the Sierra Nevada Mountains for San Francisco, Calif., is reproduced herewith, together with a tabular construction program showing by years the amounts already expended and to be spent on different elements of the project—not including the city distributing system, which will not be taken up at present. The profile and the table have been taken from a pamphlet report by M. M. O'Shaughnessy, City Engineer of San Francisco. The following extracts from the report supplement the profile and table and explain how and why the Freeman plan of 1912 (described at length in *Engineering News* of Dec. 26, 1912) has been modified as to capacities of some sections of the project:

The Hetch Hetchy will be the first reservoir site utilized, and the Lake Eleanor and Cherry Valley dams will be built later, as the necessity for increasing the water-supply beyond the capacity of the Hetch Hetchy watershed arises. The aqueduct in the initial development will consist of 88 mi. of pipe 5 to 5½ ft. in diameter, and 66 mi. of tunnels 10 to 10½ ft. in diameter, a total length of 154 mi. to the county line of San Francisco. After the first 19 mi. of aqueduct from Early Intake is completed, the water will be dropped 1,300 ft. through an electric generating station at Moccasin Creek, where an average of 66,000 hp. will be available. An ultimate consumption in the San Francisco Bay region of 400,000,000 gal. daily from this source is contemplated, and the aqueduct tunnel above the power house is designed for this quantity, so that the full amount of water may be diverted and used in the power house at once, thereby safeguarding the city's water rights and giving the city a marketable asset at an early stage of development. Below the power house the tunnels from Moccasin Creek to the east foothills of the San Joaquin Valley are at present designed for 200,000,000 gal. daily, as the full quantity will not be required by the city for many years and as the saving in first cost and interest will greatly exceed the cost of driving a second parallel tunnel when it becomes necessary to do so at a later date. The tunnels in the Coast Range have been designed of the size specified, for the same reason. The San Joaquin Valley pipe and the pipe from Irvington to San Francisco are made of only 60,000,000 gal. daily capacity, also to save initial cost and interest on premature investments.

The Freeman plan of 1912 called for all tunnels to be built at once for 400,000,000 gal. daily capacity, the San Joaquin Valley pipe line for 240,000,000 gal. daily and the pipe line from Irvington to San Francisco for 50,000,000 to 100,000,000 gal. daily. In the interests of economy and due to the restrictions in utilization of irrigation waters in the Raker Bill [Act of Congress] the size of initial installation has been modified as already described.



Year	General Engineering, Legal Expense, Water-Supply Investigations, Hydrography*	Lands, Water Rights, Rights-of-way*	Hetch Hetchy R.R.†	Lower Cherry Canal and Temporary Power Plant†	Hetch Hetchy Reservoir	Hetch Hetchy Aqueduct: Tunnel from Early Intake to Moccasin Creek	Hetch Hetchy Aqueduct: Tunnel from Moccasin Creek to East Side of San Joaquin Valley	Hetch Hetchy Aqueduct: San Joaquin Valley Pipe Line	Hetch Hetchy Aqueduct: Coast Range Tunnel	Hetch Hetchy Aqueduct: Pipe Line from Irvington to San Francisco	Moccasin Creek Power Plant, Initial Installation, 37,500 Kw.	Totals for Entire System
1900 to 1915	$558,000	$1,285,000	$200,000	.....	$150,000	$74,000	.....	.....	.....	.....	.....	$2,267,000
1916	65,000	25,000	1,650,000	$120,000	160,000	50,000	.....	$5,000	$10,000	.....	.....	2,085,000
1917	.....	.....	.....	120,000	700,000	750,000	$10,000	30,000	125,000	$10,000	.....	1,745,000
1918	.....	.....	.....	.....	900,000	1,300,000	40,000	65,000	1,000,000	40,000	.....	3,345,000
1919	.....	.....	.....	.....	1,100,000	1,300,000	150,000	300,000	1,500,000	250,000	.....	4,600,000
1920	.....	.....	.....	.....	1,140,000	1,300,000	500,000	700,000	2,000,000	700,000	$1,400,000	7,740,000
1921	.....	.....	.....	.....	.....	1,300,000	1,000,000	1,300,000	2,000,000	1,300,000	2,000,000	8,900,000
1922	.....	.....	.....	.....	.....	.....	1,200,000	1,300,000	3,000,000	1,300,000	.....	6,800,000
1923	.....	.....	.....	.....	.....	.....	1,100,000	1,300,000	3,000,000	1,265,000	.....	6,665,000
Totals...	$623,000	$1,310,000	$1,850,000	$240,000	$4,150,000	$6,074,000	$4,000,000	$5,000,000	$12,635,000	$4,865,000	$3,400,000	$44,147,000

* Expenditures under this head after 1916 are included in construction costs of reservoir, aqueduct and power plant. † Cost of operation and maintenance of railroad and power plant is included in construction cost of reservoir and aqueduct.

PROFILE AND CONSTRUCTION PROGRAM OF HETCH HETCHY WATER-SUPPLY FOR SAN FRANCISCO

A considerable part of Mr. O'Shaughnessy's report is devoted to a review of the history and staff organization of the Los Angeles and Catskill aqueduct projects, consisting of both text and diagrams.

Master Mechanics Report on Locomotive Practice

The annual meeting of the American Railway Master Mechanics Association was held last week in Atlantic City, following the convention of the Master Car Builders Association held the previous week. The total enrollment of members at both conventions was about 750; something over double that number of supplymen were registered, and the registration of ladies and guests increased the total to nearly 3,900. The exhibit of railway supplies and appliances in connection with the conventions was fully up to the standard set by previous years and fully equaled, if it did not exceed, in technical value the proceedings of the convention itself.

Among the reports of special interest presented to the convention were those of the Committee on Superheated-Steam Locomotives. On Jan. 1, 1916, there were 15,666 locomotives with superheaters in service in the United States and Canada. At the present time, practically all new road locomotives built are equipped with superheaters, and many roads are ordering them on new switching engines. In addition, superheaters are being applied to many existing locomotives that are of modern design and in good condition.

The committee reported that locomotive superheaters save 15 to 25% in fuel consumption and 20 to 30% in water consumption in everyday operation, while numerous tests have shown higher economies. Even more important in practical operation is the increase in the power of the locomotives obtained by superheaters. On a number of railways the application of superheaters has reduced the time of freight trains on the road 10 to 15% and at the same time eliminated one stop for coal and two stops for water on a freight-engine division.

The standing Committee on Mechanical Stokers reported that, 418 locomotives have now been equipped with mechanical stokers, distributed among the different makes as follows: Street, 866; Crawford, 413; Standard, 100; Hanna, 39. In 1911 only 12 locomotives with mechanical stokers were in use. While the machines are giving satisfactory service and are admitted to be a necessity on the heaviest class of locomotives, they are still undergoing development and improvement.

A departure in locomotive practice which is in its infancy, but which in the opinion of some is likely to have important development, is the use of powdered coal as fuel. Three powdered-fuel locomotives are in service—one on the New York Central, one on the Chicago Northwestern and one on the Delaware & Hudson. The last-named machine was on exhibition at the convention. In the discussion on the possible future development of powdered fuel much emphasis was laid on the difficulty and danger in storing powdered coal for any length of time on account of the liability to heating and spontaneous combustion. An engineer who has been in charge of the work with powdered coal on the Chicago & Northwestern advised against storing more than 10 to 15 tons at one time.

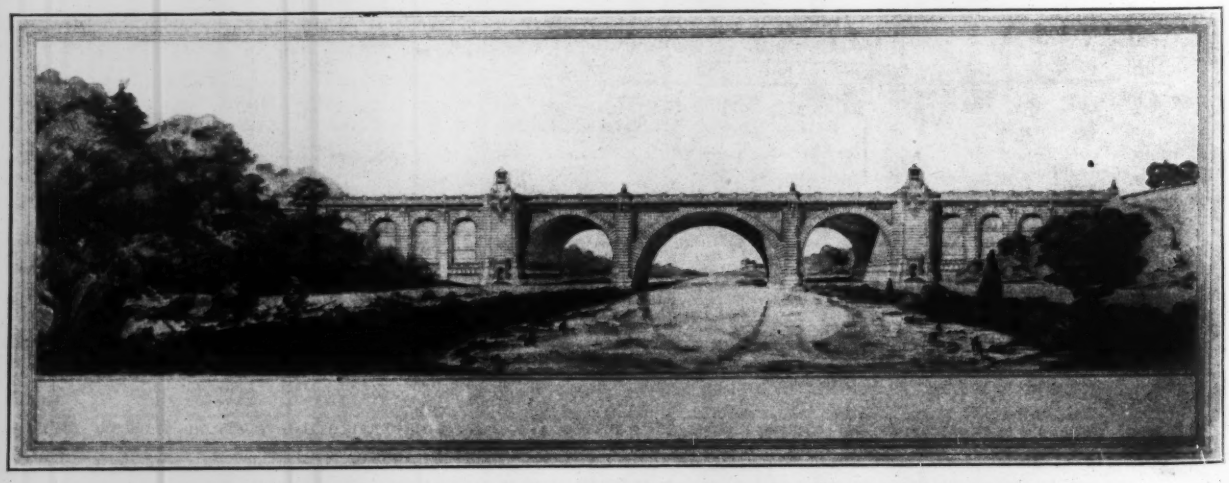
A report on train resistance and tonnage rating was presented giving new figures for the computation of train resistance for exceptionally heavy cars and confirming previous reports of this committee. Curve resistance should be taken at from 0.8 to 0.9 lb. per ton per degree of curve instead of 0.5 lb. per ton per degree, used in many of the older formulas.

The election of officers resulted as follows: President, William Schlafge (Erie); vice-presidents, F. H. Clark (B. & O.), W. H. Tollerton (Rock Island), C. S. Giles (L. & N.); members of the executive committee, J. Purcell (Santa Fe), M. K. Barnum (B. & O.), W. E. Dunham (C. & N. W.), M. F. Kinney (Hocking Valley).

Elaborate Concrete Bridge for Philadelphia Park

A highly ornamental park bridge is about to be started by the City of Philadelphia across Pennypack Creek, in the new Pennypack Park in the northeastern limits of the city. It is on the line of Bensalem Ave. and will form a part of that section of the Lincoln Highway extending from Philadelphia to New York.

The bridge, an architect's perspective of which is shown herewith, is to be of solid concrete, with a middle 100 ft. arch flanked by two 60 ft. arches and approaches of earth



ARCHITECT'S DRAWING OF NEW BENSALEM AVE. BRIDGE IN PHILADELPHIA

fill retained by solid concrete walls. The bridge carries a 54-ft. roadway and two 12 ft. sidewalks. It is designed so that it may in the future have a double-track electric railway. The bridge floor is about 60 ft. above the stream bed.

A special effort has been made to detail and ornament the structure in an artistic fashion. In addition the surface, to be made by the familiar scrubbed finish common to many recent Philadelphia bridges, will be the subject of special attention in construction.

The Bensalem Ave. bridge is to be built under the general direction of George E. Datesman, Director of the Department of Public Works, and Chester E. Albright, Chief Engineer of the Bureau of Surveys. Jonathan Jones, Assistant Engineer in charge of the Bridge Division, is directly responsible for design and construction. The contract has been let for about $200,000 to Day & Zimmerman, of Philadelphia. This price represents about $4.15 per sq.ft., including the fill in place and without paving.

Clemens Herschel, President of the Civil Engineers

Clemens Herschel, of New York City, who was elected Vice-President of the American Society of Civil Engineers a year ago, became the President of the Society, through the death of E. L. Corthell on May 16. While Mr. Herschel is thus not directly elected by the membership to this highest position in the civil engineering profession of America, the many members of the society who know Mr. Herschel and his work in the profession will agree that he is well qualified to rank with the long list of distinguished engineers who have held this office.

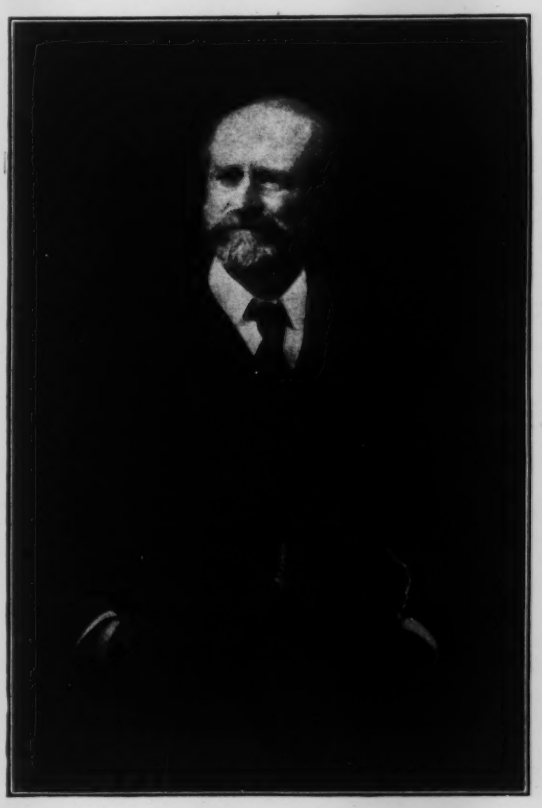
Mr. Herschel was born in 1842 and graduated from the Lawrence Scientific School of Harvard University when 18 years old, at about the age when youths of the present day are graduating from the high schools. Mr. Herschel then went abroad to pursue further engineering studies in France and in Germany, and thereby acquired a familiarity with the work of foreign engineers that was very rare at that time in the United States.

After returning to the United States he undertook a variety of engineering work, chiefly in New England. He gave much attention to bridge work and in 1875 published a treatise on continuous revolving drawbridges. He was at one time connected with the Boston sewer department and he served for two years as a member of the Massachusetts Railroad Commission. What chiefly influenced his life work, however, was a period of service under the famous James B. Francis, who was for more than 40 years in charge of the hydraulic power development on the Merrimac River in Lowell, Mass.

It was his work at Lowell, without doubt, which led to his appointment in 1879 to the position of hydraulic engineer of the Holyoke Water Power Co. During the ten years which he remained at Holyoke, he constructed the famous Holyoke testing flume, and put in force a system of metering and recording twice daily the water consumption of some 85 turbines in operation in Holyoke mills. The economy in the use of water thus secured was of great importance in securing an equitable distribution of water among the different tenants of the power company and preventing waste.

It was while engaged in this work at Holyoke that the constant need for some better apparatus for accurately measuring the flow of water in large pipes led Mr. Herschel to his invention of the venturi meter, the importance of which to the art of hydraulic engineering it would be difficult to overestimate. His work in the development of the venturi meter was described by him in the *Transactions* of the American Society of Civil Engineers for November, 1888.

It is of interest to note that some of Mr. Herschel's assistants at Holyoke who have since attained eminence



Clemens Herschel.

in the profession were J. Waldo Smith, Morris Knowles and John H. Cook.

In 1889 Mr. Herschel was made chief engineer of the East Jersey Water Co., which was then embarking on a large enterprise for the supply of potable water to the cities and towns of northern New Jersey. At this time also the wide reputation he had gained from his work at Holyoke brought to him an extensive consulting practice on important works for water-supply and water-power development. He was consulting engineer for the Niagara Falls Power Co., which undertook the first water-power development at Niagara Falls. He was a member of the commission which made a report on the practicability of the deep rock tunnel plan of distribution for the Catskill Aqueduct water in New York City. He was employed by the United States Government some years ago to investigate and report upon the development of water power at Great Falls on the Potomac.

During his entire professional career, Mr. Herschel has taken a prominent part in the work of engineering societies. He was the Treasurer of the Boston Society of Civil Engineers from 1874 to 1880, and was President of that society in 1890-91. He has been a member of the American Society of Civil Engineers since 1869, and served as a Director in 1891. He was made a member of the Institution of Civil Engineers of Great Britain many years ago.

From the very earliest days of *Engineering News,* Mr. Herschel has been a frequent contributor to its columns. His most remarkable work in technical literature undoubtedly is his translation of two books on the Water-Supply of the City of Rome by Sextus Julius Frontinus. Mr. Herschel gathered from original sources the materials for this book during leisure time for some twenty years. The writing and publication of this book well serves to exemplify Mr. Herschel's scholarship, culture, and interest in his profession. Another treatise on hydraulics, useful as a practical work of reference, is "115 Hydraulic Experiments" published by Mr. Herschel in 1897.

During his term of office as Vice-President of the American Society of Civil Engineers, Mr. Herschel has devoted much time and energy to the society's affairs. He was Chairman of the Committee of the Board of Direction which investigated the proposed removal of the New York headquarters to the Engineering Societies' Building.

Advancement of the Profession of the Civil Engineer*

By Clemens Herschel†

We stand in the shadow of the great loss this society has suffered in the death of its duly elected president, Dr. Elmer Lawrence Corthell. Succeeding to his duties and responsibilities, I have endeavored to follow out any plans he may have had for the address which he was to have delivered. It will not be foreign to his desires and aspirations if I choose for the subject of our considerations a topic that may well enlist the coöperation of us all. We have had of late in the technical press and in the proceedings of engineering societies ample evidence that the advancement of the profession of the civil engineer is a cause that has the earnest attention of the large body of thoughtful working engineers of the country. The spirit of unrest has been abroad among them. Engineers feel that they occupy a prominent place in the creation of the world's material welfare and want a recognition of this fact—a recognition that a share in the world's honors is due them in the minds and actions of their fellowmen. Especially are their unrest and a striving for increased public recognition justifiable and prominent among engineers when the creation of state or public works is under consideration.

Public works have been deemed the glory of long-established, or developed, states, since the dawn of history. To attempt to do without them or to rely solely upon private enterprise to procure them is a mere delusion, or notion—impracticable; and yet we have a national and, generally speaking, 48 state governments that make no permanent provision for their construction and upkeep in their organic law.

The expenditure of 4% of the annual United States budget on public works is made the foot-ball of politics, and great is the cry of victory when this expenditure has been reduced to 3½%; but no word is heard about the other 96 or 96½% of expenditure of the same budget, because public works are not recognized in the constitutions of the United States and of the states to the extent of providing a department of the Government and permanent officers of the Government to construct and care for them. A large part of the lack of recognition of the civil engineer as a member of an honorable profession, and of his merits, is in my belief traceable to this very state of affairs.

From time to time the technical press contains discussions as to the anomalous position held by "Junior Engineers" and "Assistant Engineers" in the service of the United States on public works in charge of the Corps of Engineers, U.S.A., the former of whom can never rise above their basic position and the best of whom consequently leave that kind of a service as quickly as circumstances will permit. These discussions are carried on in all sorts of tempers; and, to make my own temper clear in the matter, let me express the belief, founded on long personal observation and friendships, that there does not exist an abler, a finer body of men than this same Corps of Engineers, U.S.A. Think of its genesis. A boy must have ambition, must be a select boy, to aspire to go to West Point. Competitive examinations in the majority of cases cull out the best of these to go there. Four years' training and schooling and their consequent process of selection reduce the number who enter to the half that is able to graduate. And of these, only the four or five at the head of the class go into the Corps of Engineers.

Evidently the population of the United States cannot produce better men than these four or five, thus marked for high honors. The trouble is not there. It is because the whole system of carrying on the civil-engineering works of the United States is an emergency makeshift, born of a denial of the propriety of the nation to build *any* civil-engineering works and of the *necessity* of building them, when their construction could no longer be avoided, by makeshift methods.

Says Laurence Sterne in his "Sentimental Journey": "They order this matter better in France." And not only in France, but in every country of the globe except in Great Britain and in the United States. All other countries except Great Britain and the United States have a Ministry of Public Works and, carrying on the business of this department, a corps of commissioned civil engineers. To that must the United States and every state in the Union come, sooner or later. Commissions of laymen to rule in these matters, appointed as an emergency measure, are an anomaly in these days of striving for efficiency.

Let me illustrate how the commission habit in state government operates, as philosophically viewed from a distance. A certain state conceived the idea that it would be well to develop its principal seaport by works of the civil engineer. So a commission of laymen was created to cause this to be done. The newspapers were replete for months as to who should be the chairman of this commission. There was a good salary attached. Not a word

*From the presidential address before the annual convention of the American Society of Civil Engineers.

†2 Wall St., New York City.

as to the civil engineer capable of designing the necessary works and of wisely superintending the expenditure of millions of dollars in the future. At length the die is cast, and the favorite of the "plum-tree" enters upon a course of the at-such-times customary after-dinner speeches. After months of this sort of thing and when the novelty of the situation has worn off not much has been heard in the daily press as to the work to be done. An engineer has indeed been somehow appointed and certain work planned and done. Then the former after-dinner speaker resigns, or is crowded out, it is immaterial which, changes of political government affect and *debase* the at-no-time illustrious commission and engineering corps, and the last end of that commission is worse than its inception; it is *itself* swallowed up and abolished in a reshuffling of the commissions of the state generally; and all this in the space of barely five years.

Does one not see, in contemplating such bits of contemporaneous history, that especially in a republic are commissioned civil engineers needed for the proper carrying on of the public works of the state? The reason the average Congressman and even the Executive respects the army engineer, as they do, is because the former knows that the services of the latter in and to the Government will go on, when he himself will not unlikely have been wholly forgotten. He would equally respect the commissioned civil engineer.

The layman chief-of-bureau's tendency to lack of consideration for his expert subordinate must be checked by the expert's permanence in the service, or else we can get no results in public works such as the state ought to have.

To illustrate again, where else than in the United States would it have been possible for a dreamer of patriotic visions in the service of the Government to have seen those visions come true under his able guidance in the space of some 15 years and at an expenditure of scores of millions of dollars; creating empires of arable land, where before was the desert; and after the threat of political removal by one brief layman incumbent of the chair at the head of his bureau finally be made to succumb, without any justification that the public ever heard of, by another such brief incumbent, to the already manifested harm of the service and of its future.

No amateur ruling the immediate present of an important Government work and agency should have such subversive powers of harm for their future. No matter even that he act from motives which to him at the moment seem wholly good. He may be mistaken. Certain it is that a system that enables a mere passing temporarily exalted incumbent of an office thus radically to disorganize, out of his own mere motion, a work of national usefulness and importance is not for the good of the body politic. In a republic, with its short-lived, kaleidoscopic, ever-changing individual leadership form of government, even more than in a conservative monarchy, the servants of the state on public works should have fixity of tenure of office.

The advancement of the profession of the civil engineer can be viewed from many another angle. We have, for instance, the work of combining the efforts of the various branches of the engineering profession in matters of their common interest. According to Section 2 of Article II of our constitution, there are no engineers, except civil and military engineers—the original class distinction. But so various are today the occasions when it is necessary to apply "the art of directing the great sources of power in nature for the use and convenience of man" that it long ago became impracticable to have all engineers in the United States enrolled in one American Society of Civil Engineers. Instead, we have the four prominent national engineering societies and many amply useful, though less prominent engineering societies. Many have labored in season and out of season to bring about joint action of the engineers of the United States in matters of a common interest. This society has said that it believes in it; and as a step in that direction and a beacon light to the public that engineers are at their posts of duty and should be recognized and reckoned with, we have said that the building of the four Founder Engineering Societies on 39th St., in the City of New York, shall represent to the public the home of a power in the land. The step we have taken and which has been voted in the affirmative, 2,500 for, 390 against, is of course but a beginning. It has been worked for in a duly humble spirit and on the principle of doing one thing at a time, but the beneficent end of that work no man can see.

Lively Summer Meeting of the Civil Engineers

For a Summer Meeting unusual life pervaded the doings of the American Society of Civil Engineers at Pittsburgh on Tuesday of this week. Besides two notable addresses there was the long-looked-for announcement of the ballot on moving headquarters to the United Engineering Society Building. Chicago polled 60 votes for next meeting place out of a total vote of 443. It was announced that hereafter the summer meetings will be held by rotation in the various districts. The excursions exhibited the industrial life of the Pittsburgh district. There was a dinner-dance Tuesday evening. To top off the activities, an all-day golf tournament was scheduled for Friday. The pipe of peace will be smoked Friday evening, June 30—the smoker being given by the Engineers Society of Western Pennsylvania. At the opening session an address was given by John A. Brashear, Past President American Society of Mechanical Engineers. Mr. Brashear dealt with the relation between science and engineering. Portions of the presidential address of Clemens Herschel are given above.

On moving headquarters from the present Society House on 57th St., to the United Engineering Society Building on 39th St., New York City, 2,963 valid ballots were cast. Of these, no less than 2,500 voted for and only 390 against accepting one of the two invitations to move into and become part owner of the building. Whether the building shall be heightened or quarters found and adapted in the building as it now stands was left to the Board of Direction by a vote of 1,795 to 524, but 1,096 to 248 expressed a preference for Plan A (adding to the height of the building), while only 194 favored Plan B (utilizing existing space) compared with 695 who voted against it.

The Special Committee on Concrete and Reinforced Concrete was the center of a lively discussion. It was alleged that it had incurred expenses beyond the wishes of the Board of Direction and had not answered requests of the Board for information as to progress. The discussion was terminated after the members, who took part in it, made it plain that a final report is desired.

News of the Engineering World

Engineering Foundation Plans Research Federation

The Enginering Foundation (the initial endowment of which was received last year from Ambrose Swasey, of Cleveland, and is administered "in the interest of scientific research and the good of mankind" through the engineering profession by trustees from the national Societies of Civil, Mining, Mechanical and Electrical Engineers) has decided to offer its services to the National Academy of Sciences of the United States "to accomplish the federation of all the research agencies of the nation, governmental, university and private, with the object of encouraging the application of scientific principles to American industries and the employment of science in the national defense."

It has been decided to spend from $8,000 to $15,000 per year on a competent executive secretary to assist in the above organization. An important addition to the financial resources of the Foundation has been made by Mr. Swasey.

Engineering for Communities

The engineering aspects of community improvement and development work were among the several subjects considered at a "Better Community Conference" held at the University of Illinois, Urbana, Ill., June 20 to 22. City planning, landscape work, parks and fire-prevention were subjects of a semi-technical character.

Good roads were discussed in relation to the bond-issue system now becoming so popular as a means of raising the necessary funds. In particular, the history and promotion of the $1,500,000 bond-issue of Vermilion County, Ill., was reviewed by Harvey C. Adams, President of the Danville Chamber of Commerce. The coöperation of small neighboring communities in employing an engineer for their mutual requirements was the suggestion of H. E. Babbitt (University of Illinois) in a paper on the value of an engineer to the small community.

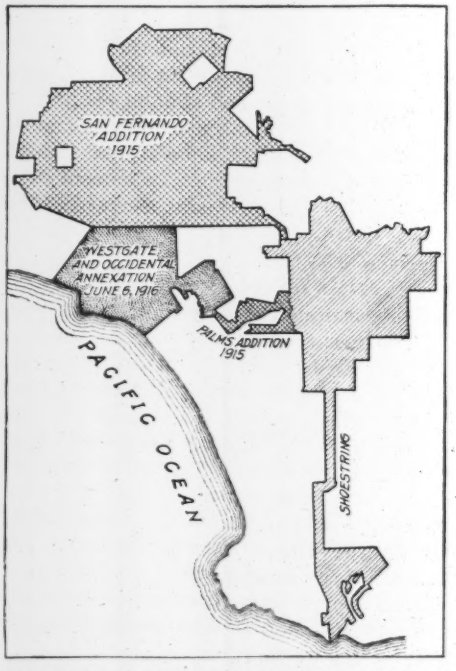
The engineering and medical sides of the public-health problem in rural districts and small communities were covered in a group of papers presented mainly at the Public Health Session. This had an attendance of about 100, made up largely of mayors, health officers of Illinois cities, and officials from the State Board of Health. Dr. John A. Robison, President of the Illinois State Board of Health, outlined present and projected activities of the Board. Development of the sanitary engineering division and a program for county health officers were among the important items mentioned. Dr. Marc White, of the United States Public Health Service, spoke on rural sanitation, presenting the great difficulties in the way of improvement, particularly due to the personal prejudices of the individual. He recommended much personal house-to-house work, with an occasional vigorous enforcement of the law.

Dr. Ruediger, Director of the coöperative health laboratory, which serves Peru and LaSalle, Ill., spoke on coöperative health work in small communities. He stated that 77% of the residences in Peru and 42% of those in LaSalle are not connected with the sewers.

Other papers included: "Water Supply and Sewerage," by Paul Hansen, Chief Engineer of the State Board of Health; and "Collection and Disposal of City Wastes," by Samuel A. Greeley, Consulting Engineer, Chicago, Ill. As a result of the Public Health Session, there was organized the "Illinois Association for Public Health and Welfare"; Honorary President, Dr. Robison; President, Dr. G. T. Palmer, Springfield, Ill.; Secretary, Paul Hansen, Springfield, Ill.

Los Angeles Adds to Area and Irregular Shape

By voting to annex two tracts on June 6, Los Angeles increased its area beyond that of any other city of the United States and added to the irregularities of a boundary line already remarkable for angles and zigzags and for areas which are geographically within yet politically without the city limits. What the city



RECENT ANNEXATIONS TO LOS ANGELES, CALIF.

looks like in general outline with the latest annexed territory is shown by the accompanying sketch map, which also serves to show the very large area added to the city in 1915 as well as its area before that date.

The total area of Los Angeles, including the latest additions, is about 338 sq. mi., as compared with 315

sq.mi. for New York City, 198 for Chicago, and 129 for Philadelphia. The two districts just annexed are known as Westgate and Occidental, and have areas of 48.67 and 1.04 sq.mi. respectively. The San Fernando addition of 1915, which came in to get surplus waters of the Los Angeles Aqueduct, has an area of about 160 sq.mi. and the Palms addition of the same year has an area of about 7 sq.mi.

The long, narrow strip or "Shoestring" leading southward was annexed in 1906, together with some territory to the north and to the south, as a preliminary to annexation of the former cities of Wilmington and San Pedro, still farther to the south, which were taken in three years later in order to make Los Angeles a seaport. The Westgate addition gives Los Angeles still more ocean frontage. It stops short on the south just at or above Santa Monica. The voters of Los Angeles refused on June 6 to adopt an initiative ordinance which would have permitted the city to sell water to Santa Monica and other areas which do not first ask for annexation.

Water Meters Cut Consumption

The use of water meters in the Massachusetts Metropolitan Water District reduced the water consumption for the year 1915 to a total less than that of any year since 1899, according to the 1915 report of the district, just published. The district includes Boston and 17 other municipalities. A legislative act requiring meters to be installed on all service pipes in the district went into effect on Jan. 1, 1908. The total daily consumption at that time was more than 125,000,000 gal. Since then the reduction has been marked and almost uniform in rate. The total consumption for 1915 was 101,941,500 gal., or 88 gal. per capita for an estimated population of 1,164,600.

Engineering Teachers Meet

The 24th annual meeting of the Society for the Promotion of Engineering Education was held at University of Virginia, Charlotteville, Va., June 19-22, with about 140 present. The program was very full so that much of the discussion had to be curtailed. Much time was given up to the Mann report on engineering teaching as reported elsewhere in this issue. Some of the committee reports turned on similar matter. For instance, the Committee on Mathematics and the Committee on Physical Sciences discussed the better relation of courses in these fundamental subjects to courses which preceded and followed, and to better coördination in general. The paper by Hollis Godfrey, President of Drexel Institute, Philadelphia, related how an effort was being made to create a happier atmosphere and to giving the instructors a better knowledge of the art of teaching. A paper on teaching chemistry at the University of Virginia, by R. M. Bird, showed how the instruction was tied in with commercial affairs, and a high degree of interest sustained.

The Committee on Entrance Requirements recommended requiring evidence of ability in mathematics, science, language, and general subjects—rather than preparation. The Yale and Harvard plan was commended of using four examinations in these subjects, plus the secondary-school rating so that students entered without conditions or not at all. The committee commended efforts to make college preparation less conventional and less subservient to tradition, and called attention to the admission among requirements of practical subjects like manual training.

The Committee on Administration reported an investigation of the time of teachers given to outside work. They found that one-fourth the vacation time was given to professional work, and one-fourth to rest and recreation, the rest being given to teaching, preparation, research, etc. About half the men did outside work in school years but so spent only from 2 to 15% of their time.

In the presidential address on "Some Details in Engineering Education," Prof. H. S. Jacoby drew some parallels between the progress in engineering methods and in the methods of teaching engineering. He recommended the wider use of diagrams and graphic presentation, with care always to fully explain the meaning and use. He cautioned instructors, in the use of problems, to preserve the practical nature and give ample time for solution by limiting the scope. The art of quizzing should be developed and printed directions used in various courses to save time on routine matters for devotion to essentials. He urged fixing dates for reports from students to stimulate promptness. The student should be led to develop the art of reading, particularly reading engineering periodicals. He had found that student activities might handicap the student's work, so that they should be limited and subjugated. Better provisions were needed for developing teachers.

The following officers were elected for the ensuing year: President, G. R. Chatburn (University of Nebraska); vice presidents, Hollis Godfrey (Drexel Institute) and W. M. Thornton (University of Virginia); secretary, F. L. Bishop (University of Pittsburgh); treasurer, W. O. Wiley, of New York City.

U. S. Supreme Court Upholds Oregon Water Board

By M. M. Mers*

The recent decision of the Supreme Court of the United States in the case of the Pacific Live Stock Co. vs. Lewis *et al* (June 5, 1916) is of vital interest, not only to the engineering profession, but to the public as well. It holds constitutional the Oregon Water Code, and defends the right of the state to ascertain and establish rights to the use of the waters of its stream in the simple, effective and comprehensive manner outlined therein. The essential difference between the proceeding before the State Water Board, and the usual court procedure, lies in the latitude given the Board in securing independent information, and considering engineering data based upon the surveys and investigations of the state engineer. The informality of the proceeding, its economy and fairness, have appealed to irrigators as offering the best and quickest method of settling their water disputes, and securing the protection of the state's police power in distributing water. The United States Supreme Court, by its decision, has secured to Oregon for all time, the benefits and protection of this statute, and the opponents of the law have been effectually silenced.

*Secretary, Oregon State Water Board, Salem, Ore.

The law has been attacked from every possible angle—as to the fees required to be collected, the manner of accepting the statement of water claimants, and the admission of the state engineer's report as evidence. It was alleged that the statute violated the 14th Amendment to the Federal Constitution providing that no property shall be taken without due process of law.

The court rules that the fees charged were reasonable and just, that the claims filed were opened to inspection and all parties given an opportunity to contest them, and that the state engineer's report enabled the Board to make a more equitable and accurate ascertainment of the various rights than could be secured by other evidence. It was found that ample notice of each step in the proceeding is provided for, and that no one is deprived of property under this statute, in violation of the 14th Amendment. It protects the state in its rights to make a comprehensive determination of water rights from an entire stream system, instead of considering each controversy separately, and apart from its relation to other claims. Private suits are suspended by the larger issues, and the stream system as a whole is made the subject of adjudication.

The decisions of the Oregon Supreme Court upholding this statute were quoted with approval, and the proposition made that the Board act in an advisory capacity to the courts in ascertaining water rights—the initial steps taken by the Board being merely parts in a single statutory proceeding.

To sum up, the importance of this decision with relation to the development of the water resources of Oregon and all other western states and the elimination of vexatious litigation, can hardly be overestimated. This decision will enable the various states to establish administrative boards composed of engineers and experts to handle all matters pertaining to the administration of the streams, just as there is now a railway commission to handle all matters pertaining to railways.

⁂

A 42-In. Water Main Burst in Copley Square, Boston, about 6 a.m., June 21, at a point where excavation had been made by the Boston Consolidated Gas Co. A considerable amount of damage was done by the water, which flooded the streets, entered the engine room of the Boston Public Library and the basements of a number of stores and hotels. Water rushed through Dartmouth St. and down the stairs of the entrance to the westbound subway in Boylston St. until it was stopped by a dam of sand bags. The main was of cast iron and was laid in 1896. An entire 12-ft. section of pipe was split completely in half, both at the top and bottom. It is said to be the worst accident of the kind which has happened in Boston for the past 30 years.

In a Shaft Accident at the L St. bridge tunnel, South Boston, Mass., on June 24, four men were killed and one injured. This tunnel has recently been started by Hugh Nawn, contractor for the Boston Edison Illuminating Co. It will run under Reserve Channel and carry electric conduits. The accounts of the accident are contradictory and no authentic information has been made available. It appears that a brick shaft, 7 ft. in diameter and with 16-in. walls had been sunk 80 ft.; on top was an air lock. Excavation for the tunnel had started. The night shift had left and the day shift just gone on; four men were in the bottom, two were in the air lock and one was on top when the accident occurred. About 30 lb. air pressure was on. There appears to have been a collapse of the shaft walls about a third of the distance down, followed by a lifting of the air lock and upper shaft walls, giving rise to reports of an explosion. Water and sand rushed in and filled the shaft.

Protection of a Large Gasoline Tank at Balboa, on the Panama Canal, against accidental ignition of its contents is being carried out on the Martini-Hueneke system. The principle of the system is the maintenance of a blanket of incombustible gas in the storage tank above the surface of the gasoline. The plant consists of a gasoline engine driving a gas compressor, gas scrubbers, and an inert-gas storage tank. The inert gas used is the exhaust from the gasoline engine, which is cooled, scrubbed and compressed into a high-pressure storage tank. As fast as gasoline is drawn out of the storage tank the inert gas is automatically supplied to the space above the gasoline, so that no air is drawn in. The contract cost of the equipment was $2,950.

Congressional Action on Pending Water Power Bills is urged by the Joint Conference Committee representing the national engineering societies. At a meeting on June 16 this committee adopted the following resolutions:

The Joint Conference Committee of Engineering Societies believes that the development of the country's undeveloped water power will increase national prosperity; that private enterprise should be encouraged and stimulated to expedite such development; unnecessary legal burdens should be removed and existing doubts as to the safety of investment eliminated. It commends to the support of engineers all efforts made to secure the fullest publicity as to the underlying facts regarding this subject.

The Centennial of Public Gas Lighting in America has just been celebrated in Baltimore, which was the first city in the United States to establish public gas lighting. The Gas Light Co. of Baltimore on June 17, 1816, received a franchise from the City Council to lay pipes for distributing gas. This was only four years after the introduction of gas light in London by the Gas Light and Coke Co., the first gas undertaking in the world. Boston introduced gas lighting in 1821 and New York City in 1823. In commemoration of the centennial, the Consolidated Gas, Electric Light and Power Co. of Baltimore has issued an attractive booklet, giving the history of gas lighting in Baltimore and elsewhere.

PERSONALS

W. P. Latham has resigned as Superintendent of Streets of Northampton, Mass.

W. V. Cullen has been appointed Manager of the newly opened St. Louis, Mo., office of the Jeffrey Manufacturing Co., of Columbus, Ohio.

I. U. Jones has been appointed Manager of the newly opened Dallas, Tex., office of the Jeffrey Manufacturing Co., of Columbus, Ohio.

Frank Strong has been appointed Division Engineer of San Pedro, Los Angeles & Salt Lake R.R., with headquarters at Salt Lake City, Utah.

G. E. Hill, for several years Deputy City Engineer of Pasadena, Calif., has been appointed City Engineer, succeeding John MacMillan, resigned.

James H. Edwards, M. Am. Soc. C. E., Assistant Chief Engineer of the American Bridge Co. of New York, has been reëlected an alumni trustee of Cornell University.

A. B. McDaniels, M. Am. Soc. C. E., Assistant Professor of Civil Engineering, University of Illinois, has resigned to become Assistant Professor of Civil Engineering at Union University, Schenectady, N. Y.

W. C. Campbell, Assoc. M. Am. Soc. C. E., recently Superintendent of Public Works and City Engineer of Columbus, Ga., has opened an office for private practice in the Commercial Bank Bldg., Charlotte, N. C.

Fred W. Waterman, M. Am. Soc. M. E., Mechanical Engineer of the National Tube Co. plant at Lorain, Ohio, has been appointed Superintendent of the new tube mills of the United States Steel Corporation at Gary, Ind.

Lynn Crandall, Assoc. M. Am. Soc. C. E., recently Assistant Engineer, United States Geological Survey, Salt Lake City, Utah, has been appointed Chief Hydrographer of the Twin Falls North Side Land and Water Co., at Jerome, Idaho.

George T. Snyder, M. Am. Soc. M. E., Mechanical Engineer of the McKeesport (Penn.) plant of the National Tube Co., has been made Mechanical Engineer of the Lorain, Ohio, plant, succeeding Fred W. Waterman, resigned, as noted elsewhere.

A. J. Fasenmyer, recently attached to the district office of the Pennsylvania State Highway Department at Franklin as a draftsman, has been promoted to be Road Superintendent of Blair and Cambria Counties, succeeding R. L. Devereaux, resigned.

D. A. Peters, recently with the engineering department of the Lake Erie & Western R.R. at Indianapolis, Ind., has been made Superintendent of the Sandusky division of that railroad and of the Northern Ohio R.R., succeeding George Dyer, promoted, as noted elsewhere.

Joseph E. Kuhn, Colonel, Corps of Engineers, U. S. A., now a military observer with the German army, is to be placed in command of one of the three new engineer regiments to be organized under the new Army Reorganization Act. Colonel Kuhn's regiment will have headquarters in the Philippines.

George A. Zinn, Colonel, Corps of Engineers, U. S. A., now stationed at Philadelphia, is to be placed in command of one of the three new engineer regiments to be organized under the new Army Reorganization Act. Colonel Zinn's regiment will have headquarters at Columbus.

L. B. Morehead, recently Chief Draftsman of the Chicago, Indianapolis & Louisville Ry., has been appointed Mechanical Inspector of the Lehigh Valley R.R., with headquarters at Sayre, Penn. He was formerly Assistant Engineer of the Illinois Central R.R. at Cleveland, Ohio.

George Dyer, for several years Superintendent of the Sandusky division of the Lake Erie & Western R.R. and the Northern Ohio R.R. at Lima, Ohio, has been promoted to be General Superintendent of the Lake Erie & Western R.R., a newly created office. His headquarters will be at Tipton, Ind.

Mason M. Patrick, Lieutenant-Colonel, Corps of Engineers, U. S. A., now stationed at Detroit, is to be placed in command of one of the three new engineering regiments to be organized July 1 under the new Army Reorganization Act. He will become a colonel at that time. The regiment will have headquarters at Fort Sam Houston, Tex.

J. S. Allen, of Greenville, Miss., has been appointed Chief Engineer of the Highway Commission of Washington County, Mississippi. **O. C. Kolleka** has been appointed Assistant Engineer of the commission. The proposed work consists in the construction of about 150 mi. of roads at an estimated cost of $950,000. Preliminary surveys will be started about July 15.

Pennsylvania State College announces the following promotions: J. R. Lapham to be Assistant Professor of Civil Engineering; F. J. Lewis to be Instructor in Civil Engineering; Gilbert Morrison to be Instructor in Engineering Drawing, and R. B. Nesbitt to be Instructor in Civil Engineering.

Edgar K. Ruth, Assoc. M. Am. Soc. C. E., Assistant Engineer, Division of Structures, City Engineering Department, Cincinnati, Ohio, has been appointed Assistant Professor of Civil Engineering at the University of Cincinnati. He is a graduate in civil engineering of the Rensselaer Polytechnic Institute, class of 1909, and has been with the City of Cincinnati since 1912.

Lewis Focht, Assoc. M. Am. Soc. C. E., of the New Jersey State Department of Taxes and Assessment, Trenton, N. J., and **Willis Whited,** M. Am. Soc. C. E., Engineer of Bridges of the Pennsylvania State Highway Department, Harrisburg, Penn., have been appointed to represent their respective states in making a valuation of all toll bridges across the Delaware River between Trenton and Port Jervis. This is the first step in the scheme to eliminate toll bridges on the Delaware.

H. H. Esselstyn, M. Am. Soc. C. E., and **L. F. Murphy,** Jun. Am. Soc. C. E., announce the formation of the Esselstyn-Murphy Co, Engineers, Penobscot Bldg., Detroit, Mich. Mr. Esselstyn as Construction Engineer of the Detroit Edison Co. has had charge of the design and construction of the Conner's Creek power plant. Formerly he was with Westinghouse Church Kerr & Co. on many notable construction undertakings. He retains his position with the Detroit Edison Co. Mr. Murphy has been Manager of the Walkerville Light and Power Co., Walkerville, Ont., and was recently engaged in valuation work for banking institutions.

Malverd A. Howe, M. Am. Soc. C. E., has retired as Professor of Civil and Architectural Engineering at the Rose Polytechnic Institute, Terre Haute, Ind. He will make his home on a farm near Northfield, Vt., his birthplace, and will devote his time to the revision of his several engineering text-books. He was born in 1863 and graduated from Norwich University at Northfield in 1882 and from Thayer School, Dartmouth College, in 1886. Since 1887 he has been Professor of Civil Engineering at Rose Polytechnic Institute. He is probably best known as the author of much-used text-books on retaining walls, arches and roof trusses.

OBITUARY

Harley H. Fate, President of the J. D. Fate Co., of Plymouth, Ohio, manufacturers of the Plymouth gasoline industrial locomotive and a line of clay working machinery, died in the Huron Road Hospital, Cleveland, Ohio, May 27, 1916. He was 42 years old. He was born in Crestline, Ohio, Feb. 19, 1873. When nine years old his father moved to Plymouth, Ohio, where was founded the J. D. Fate Co., to the presidency of which Harley H. Fate succeeded upon the death of his father in 1902.

ENGINEERING SOCIETIES

INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS.
Aug. 29-Sept. 1. Convention in Providence, R. I. Secy., James McFall, Roanoke, Va.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.
Sept. 4-7. Convention in Hot Springs, Va. Asst. Secy., E. A. Baily, 360 Pearl St., Brooklyn, N. Y.

THE TRAVELING ENGINEERS' ASSOCIATION.
Sept. 5-8. Annual meeting in Chicago, Ill. Secy., W. O. Thompson, care General Offices, N. Y. C. R.R., Cleveland, Ohio.

AMERICAN FOUNDRYMEN'S ASSOCIATION.
Week of Sept. 11. Annual meeting in Cleveland, Ohio. Secy., A. O. Backert, 12th and Chestnut St., Cleveland, Ohio.

THE AMERICAN INSTITUTE OF METALS.
Week of Sept. 11. Meeting in Cleveland, Ohio. Secy., W. M. Corse, 106 Morris Ave., Buffalo, N. Y.

NATIONAL ASSOCIATION OF STATIONARY ENGINEERS.
Sept. 11-16. Convention, Minneapolis, Minn. Secy., Fred W. Raven, 417 S. Dearborn St., Chicago.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. 12. Convention in Atlantic City. Secy., A. P. Dane, Reading, Mass.

RAILWAY SIGNAL ASSOCIATION.
Sept. 12-14. Convention in Mackinac Island. Secy., C. C. Rosenberg, Myers Building, Bethlehem, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. 18-20. Convention in Philadelphia, Penn. Asst. Secy., C. D. Fawcett, 29 West 39th St., New York, N. Y.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS.
Sept. 18-22. Convention in Chicago. Secy., W. O. Oschmann, Oliver Iron and Steel Co., Pittsburgh, Penn.

THE ROADMASTERS AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. 19-22. Convention in New York City. Secy., P. J. McAndrews.

MICHIGAN GAS ASSOCIATION.
Sept. 21-22. Annual meeting in Detroit, Mich. Secy., Clark R. Graves, Lansing, Mich.

AMERICAN PEAT SOCIETY.
Sept. 21-23. Annual meeting in Washington, D. C. Secy., Julius Bordollo, Kingsbridge, N. Y.

THE TRACK SUPPLY ASSOCIATION.
Sept. 19-22. Convention in New York City. Secy., W. C. Kidd, Ramapo Iron Works, Hillburn, N. Y.

RAILWAY FIRE PROTECTION ASSOCIATION.
Oct. 3-5. Convention in New York City. Secy., C. B. Edwards, Mobile & Ohio R.R., Mobile, Ala.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 9-13. Convention in Newark, N. J. Secy., Charles C. Brown, Indianapolis, Ind.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 9-13. Convention at Atlantic City, N. J. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. 17-19. Convention in New Orleans. Secy., C. A. Lichty, C. & N. W. Ry., Chicago.

AMERICAN GAS INSTITUTE.
Oct. 17-20. Annual meeting in Chicago. Secy., G. G. Ramsdell, New York, N. Y.

AMERICAN PUBLIC HEALTH ASSOCIATION.
Oct. 24-27. Convention in Cincinnati, Ohio. Secy., Prof. Selskar M. Gunn, Boston, Mass.

RAILWAY ELECTRICAL SUPPLY MANUFACTURERS ASSOCIATION.
Oct. 30-Nov. 3. Convention in Chicago. Secy., J. Scribner, care General Electric Co., Chicago.

International Irrigation Congress will hold its 23rd annual meeting in El Paso, Tex., next October, or at least that is the convention city in view at present. The secretary is Arthur Hooker, El Paso, Tex.

The Association of Railway Electrical Engineers will hold its annual meeting in Chicago, at the Hotel La Salle, Oct. 30 to Nov. 3. The Secretary is Joseph A. Andreucetti, Chicago & Northwestern Terminal Station, Chicago.

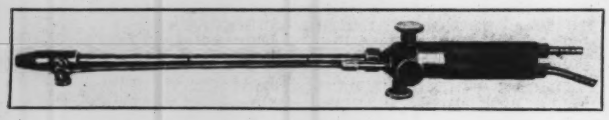
The Allied Engineers' Association of Charleston, S. C., is the name of an organization recently formed in Charleston. The membership has started at 42. The officers are as follows: President, James H. Dingle; vice-president, T. C. Stevenson; secretary, John McCrady; executive committeemen for three years, J. P. Alle and T. H. Gregg; for two years, A. W. Todd and A. M. Campbell; for one year, W. W. Fuller and W. R. Mayrant.

Engineers Club of Philadelphia—At the meeting on June 20, the Club discussed the question whether it should take action concerning the Tavenner and Van Dyke bills now pending in Congress, which prohibit the use of stop watches or other time-measuring instruments in measuring the efficiency of Federal employees. A resolution was offered by Henry Hess that the Club should take no action to favor or oppose any pending legislation, but should restrict its work to the discussion of technical subjects. The resolution was referred to the Club's Committee on Public Relations, to come up for action at the next meeting of the Club in September.

Appliances and Materials

Welding and Cutting Torch

The torch shown may be adjusted either for welding or for cutting. The head is cast in one piece and can be adjusted to serve either as a right-angle torch or a straight-



WELDING AND CUTTING TORCH

ahead cutting torch, as shown in the view. It is called the "Hoover," and is manufactured by the Oxy-Acetylene Products Co., Chicago.

* * *

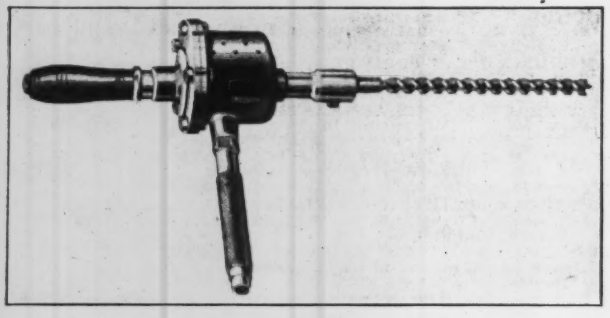
Dipping Needle for Box Hunting

A small low-priced magnetic dipping needle is being made by M. J. Breece, of Galion, Ohio, for the use of water-works and gas men in finding covered valve boxes, stop boxes, manhole covers, iron monuments, etc. Dipping needles have been found successful for several years, but only larger and more expensive instruments have been available. This costs $4.75.

* * *

Pneumatic Wood-Boring Machine

The pneumatic wood-boring machine shown herewith will bore holes up to ¾ in. in diameter through oak or pine sills at the rate of one per second with 90 lb. air pressure,



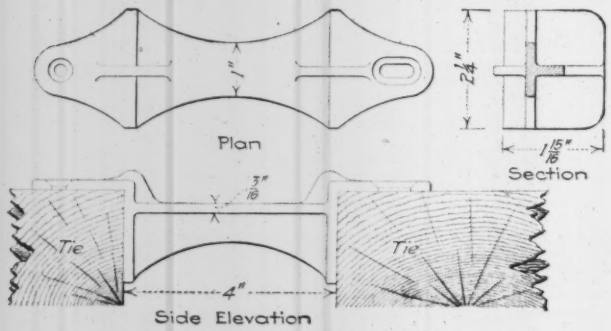
PNEUMATIC WOOD-BORING MACHINE

according to the claims of maker, the Baird Pneumatic Tool Co., Topeka, Kan. It weighs 6 lb.

* * *

Tie Spacer for Bridge Floors

To prevent bridge ties from being shifted and bunched by derailed wheels metal tie-spacers are being used in some cases as a substitute for the general practice of boxing or dapping the guard timbers over the ties. The accompanying cut shows the Q. & C. tie-spacer, which is a small casting fitted between the ties (near their ends) and having flat ends which rest on top of the ties. These ends have holes for nails, one of the holes being slotted in order to allow for expansion and contraction movements. It is suggested that where these spacers are used the guard timber may be smaller than in ordinary practice or may be omitted altogether. In the latter case, the spacers are relied upon to hold the ties in position



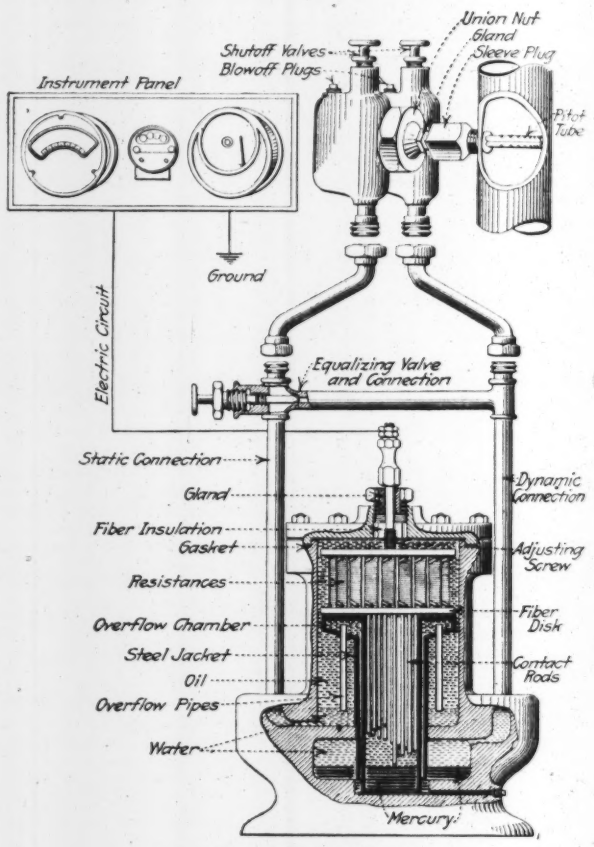
TIE SPACER FOR BRIDGE FLOORS

and the inside steel guard rails to guide derailed wheels across the bridge. This device is made by the Q. & C. Co., of New York City.

* * *

Electrically Operated Flow Meter

A new design of flow meter for water, air, steam and gas is being made by the Republic Flow Meters Co., 565 Washington Boulevard, Chicago. This comprises a pitot tube and a differential pressure gage, both of special construction. The pitot tube comprises two tubes going entirely across the flow pipe, the static- and dynamic-pressure openings being two lines of small holes at the midpoints of equal annular areas, by which it is reported a true average velocity pressure is obtained directly. The lines of holes are 180° apart. The differential pressure gage is a casting with two reservoirs, one above the other and connected by a vertical shaft. This arrangement takes the place of the usual U-tube. In the lower reservoir is mercury. Above this is water and on top of all is oil. As shown in the accompanying sketch, in



REPUBLIC FLOW METER

the reservoir well is a steel tube supporting a series of resistance spools and dependent contact rods. There is a constant-voltage (40 volts) alternating-current circuit flowing from a special transformer through the resistance and mercury to the pipe connections and thence to indicating and recording instruments. As velocity and impact pressure rises, mercury is forced from the lower reservoir up the contact-rod well, short-circuiting more and more of the resistance and displacing oil (which in the tube well rests on the mercury). The resistance units are so proportioned that the current is kept proportioned to the square root of height of mercury column and so to the pipe velocity.

* * *

Scarifier for Oil-Motor Roller

A pneumatic-control road scarifier attachment has been brought out by the Austin-Western Road Machinery Co., of Chicago, for its kerosene-engine road roller. The weight and power of the roller is applied to the scarifier in operation and the position of the toothed arm is controlled by a piston in a cylinder supplied with air from a compressor mounted above the driving-engine and driven by the engine crankshaft. Two storage tanks are connected to the air line.

Engineering News

CHARLES WHITING BAKER, *Editor*

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None sent free regularly, no returns from news companies, no back numbers.

The Ad-Editor's Page

The United States Supreme Court Says:

"An article alone is not necessarily the inducement and compensation for its purchase. It is in the use to which it may be put, the purpose it may serve and *there is deception and fraud when the article is not of the character or kind represented and hence does not serve the purpose.*"

SO RARELY does the Supreme Court of the United States deliver an opinion dealing directly with advertising ethics that there will be special interest in the decision handed down April 24, wherein the highest court in the land is placed on record as opposed to undue exaggeration in advertising. In view of current activities of the Post Office Department, the Federal Trade Commission, etc., this expression from the Supreme Court may be accounted particularly timely since it deals specifically with dishonest advertising.

In effect, the Supreme Court says that an advertiser is dishonest when he raises false expectations on the part of a customer. Mere exaggeration of the qualities possessed by an article might be condoned, although the court does not expressly say so, but when an advertiser goes farther and invents advantages for his article or assigns to it virtues it does not possess he is distinctly beyond the pale.

Only Reliable Products can be continuously advertised

Wherever people eat—these biscuits are known

Stretching the truth? Possibly, but not much. At least wherever civilized people eat, it's true. Loose-Wiles, like other makers of things to delight the taste, the ear, and the eye—Coca Cola Company, Victor Talking Machine Company, H. J. Heinz Company, etc.—choose RAYMOND Concrete Piles to set their buildings on.

The reason progressive and particular architects and engineers recommend and contractors use RAYMOND Piles is not far to seek. For the RAYMOND method combines 100% quality—**"every pile perfect from tip to top"**—with speed which quite equals the fastest of wood pile driving and far exceeds the speed possible with other concrete piles where the piles cannot be placed adjacent and simultaneously without endangering the form of the concrete and therefore the bearing value of the piles.

Raymond Method

1. A collapsible mandrel or core, measuring 8" in diameter at the point and increasing in diameter .4" per foot of length, is expanded.
2. This expanded core is encased in a sectional, spirally reinforced, sheet steel shell and is now ready for driving.
3. The combined core and shell is driven into the ground to sufficient penetration. The core is then collapsed and withdrawn from the shell.
4. The shell—which remains in the ground—is then carefully inspected as it is to be the receptacle of the GREEN concrete.
5. Carefully prepared concrete is now poured into the shell, thus forming a complete Raymond Pile, perfect from tip to top.

Simple, isn't it?

Write for some of our speed figures

RAYMOND CONCRETE PILE COMPANY

New York
140 Cedar Street

Branch Offices in all principal cities

Chicago
111 W. Monroe Street

Raymond Concrete Pile Company of Canada, Ltd., Montreal, Canada

A form for every pile~ A pile for every purpose

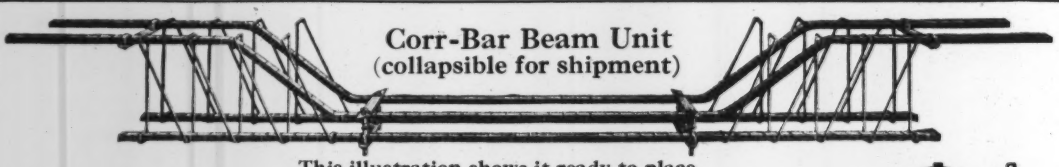
Avoid Delay by Using Corrugated Bar Reinforcement

Immediate shipments from stocks at various points

Buffalo Boston Philadelphia
Chicago St. Paul St. Louis

Some tonnage still left for Early Mill Shipment.

Our Service does it!



Corr-Bar Beam Unit
(collapsible for shipment)

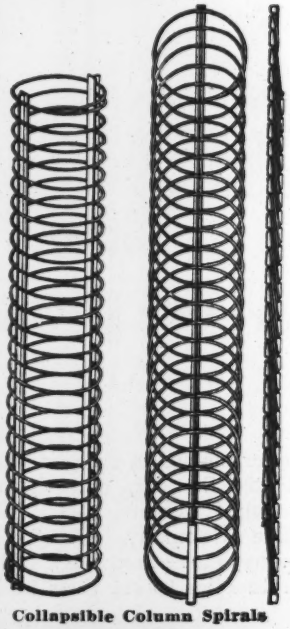
This illustration shows it ready to place

Fabricated Products

Corr-Bar Beam Units give very high values in shear. The continuous stirrup is not rigidly attached to the reinforcing bars but encompasses them. The concrete between the ribs on the bar would overcome a very strong tendency of the stirrup to slip along the bar; but no such tendency exists, as the angle which the diagonal shear member makes with the vertical is less than the angle of friction between moderately rough steel surfaces.

Corr-Bar Spirals for Columns are made from cold drawn steel wire of uniform diameter, assuring uniformity of curvature. The spacers are T section of sufficient strength and rigidity to hold the spiral in shape. They are collapsible for shipment, and readily opened upon the job.

Other Fabricated Corr Products such as beam stirrups, column hoops, radius and truss bending, are accurately and economically made at our shops by means of special machinery.



Collapsible Column Spirals

Write for Booklet on Fabricated Reinforcement.

Corrugated Bar Company, 405 Mutual Life Bldg., Buffalo, N.Y.

Boston New York Syracuse Philadelphia Chicago Detroit St. Louis

Wood Joists Give Way to KAHN Pressed Steel Beams

The old method of building with wooden joists and studs is fast being superseded everywhere by the use of KAHN PRESSED STEEL CONSTRUCTION. The reasons are clear enough. *Permanence*, *safety* and *economy* recommend the newer way.

VERMINPROOF—Decay and vermin are impossibilities.

NO CRACKED PLASTER—Hy-Rib reinforces the plaster and prevents cracking of ceilings and walls.

FIREPROOF—The danger and expense of fire is absolutely eliminated, as there is nothing about the construction that can burn.

ECONOMICAL—No forms, centering or special equipment required. Easier to build than wood. Initial cost but little more—final economy greater, because of increased worth of building and lower cost of maintenance.

For stores, schools, apartment houses office buildings, factories, residences —KAHN PRESSED STEEL is the logical construction.

Learn all about this splendid type of modern construction. New catalog is very useful to prospective builders. Write for Pressed Steel Catalog today.

Trussed Concrete Steel Co.
Dept. B-12 - Youngstown, Ohio

Representatives in Principal Cities

To shield the bridge against smoke gases and blast action from the Illinois Central trains below, the underside of the floor will be protected with a cement-gun coating, applied after slipping Mitchell-Tappen metal caging over the joist flanges. In addition there will be cast-iron blast plates 3 ft. wide hung directly over the center line of each Illinois Central track. • The construction of this cast-iron protection is shown by several sketches in Fig. 2. Cement mortar will be packed behind these smoke plates, covering the angles and bolts which hold the plates and avoiding the formation of any pockets.

Engineering literature daily recounts a new success for the CEMENT-GUN

This item which was clipped from a recent issue of Engineering News is typical of the many that have appeared attesting to its all-round serviceability.

The selection of the Cement-Gun for the work mentioned above is only natural, in the face of the many advantages of its product, Gunite, over hand-applied cement, and the ease of getting at and completing the job.

The use of the Cement-Gun assures a concrete that leads in tensile strength, compressive strength, void tests, adhesion tests, and which manifests its superiority from every standpoint.

The Gunite is placed before the initial set occurs and the setting is therefore not disturbed.

It is a foregone conclusion that the product will be a non-porous, impermeable mass, possessing the maximum density and far more waterproof than cement was ever made.

You owe it to yourself to learn the full story of the Cement-Gun. We will be glad to give you the details and to offer suggestions as to its use on your work if you will acquaint us with its nature.

Cement-Gun Company

Incorporated

South 10th and Mill Streets, Allentown, Pa.

New York Office - - 30 Church Street

A Morris Pump Is The Vital Element of This Sand and Gravel Plant

The above photo shows an efficient electrically operated sand and gravel plant in the Middle West.

The vital element of this outfit is a 10-in. MORRIS Standard Belt Driven Pump connected to 100-hp. variable speed motor. The outfit is installed on an inland pit, delivering through a 500-ft. discharge with a 10-ft. elevation, into a concrete dewatering pit. From this pit an endless bucket chain carries the sand and gravel to the screens at the top of the bins. Average capacity of the plant—about 1200 yds. per day.

Anyone considering the design of a new or the remodeling of an old sand and gravel plant, would do well to study this plant closely. Fuller details supplied on request.

Sand and gravel plants are but one of the many applications of MORRIS Pumps. Whatever your pumping problem we can help you solve it. Write us.

Morris Machine Works, Baldwinsville, N. Y.

Builders of Dredges, Centrifugal Pumps and Pumping Engines

Branch Offices in Principal Cities

No Compromise on Quality—
The Watchword at Boston "Tech."

The erection and equipment of the buildings for the new plant of the Massachusetts Institute of Technology is being done by the Stone and Webster Engineering Corporation. This engineering and construction supervision naturally embodies the broadest knowledge and experience extant and insures the selection of all the equipment on a strictly scientific basis, and it follows that, when completed, this great new plant will become a standard for the construction of all similar institutions.

EHRET'S 85% MAGNESIA

Chosen Exclusively

After thorough investigation, EHRET'S 85% MAGNESIA SECTIONAL AND PLASTIC COVERING was selected to be used for all the steam plant insulation and the execution of this part of the work was entrusted to NIGHTINGALE & CHILDS COMPANY of Boston, Mass., because of their high-grade work in this line.

Some idea of the extent of this contract may be had from the fact that the total length of pipes to be covered will exceed ***TWENTY MILES, in addition to 20,000 sq.ft. of flat surface.***

Our long experience and the fact that we concentrate exclusively in the manufacture and application of magnesiacoverings, give us unequaled opportunity to serve the architect, engineer and contractor. May we send you a copy of our standard specifications?

Ehret Magnesia Manufacturing Company
Valley Forge, Penna.

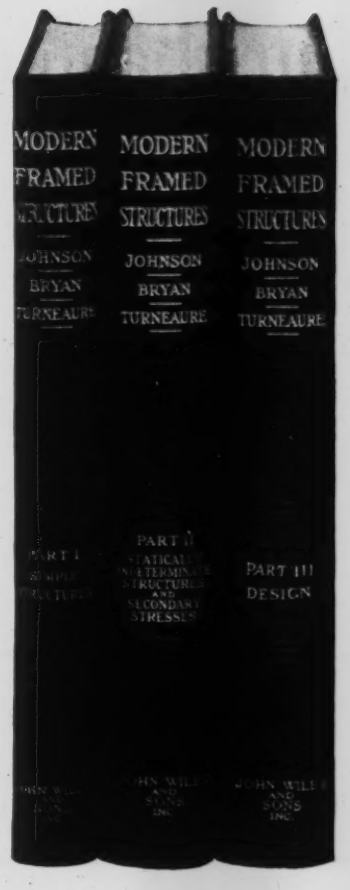
Branch Offices: Philadelphia, New York, Chicago

Now Complete

The Ninth Edition, Rewritten, of

Modern Framed Structures

By the late J. B. Johnson, C.E.; C. W. Bryan, C.E., Chief Engineer of the American Bridge Company, and F. E. Turneaure, C.E., Dean of the College of Mechanics and Engineering, University of Wisconsin.



Just Published

Part III. Design

Rewritten by Dean F. E. Turneaure, and W. S. Kinne, Associate Professor of Structural Engineering, University of Wisconsin.

"Modern Framed Structures" has been the standard reference book for structural engineers from the date of its publication in January, 1893. The Ninth and Rewritten Edition is now completed by the publication of Volume III on Design.

The cordial reception given to the new editions of Volumes I and II upon their publication a few years ago will be accorded to Part III. Although completely rewritten the general arrangement and topics covered are similar to the old work.

The subject of columns has been treated at considerable length, both from the standpoint of experiment and theory. Secondary stresses have also been considered with special reference to their influence upon design.

The analysis of plate girder stresses is more complete than usual, and care has been taken to apply rational methods of analysis and design to as great an extent as possible. Chapters on highway bridges, roof trusses, and mill building construction are also given.

List of Chapter Headings

Styles of Structures and Determining Conditions. Working Stresses; Tension Members. Compression Members. Combined Direct and Bending Stresses; Secondary Stresses. Riveted Joints. Design of Plate Girders. Design of Truss Bridges. Design of a Pin-Connected Railroad Bridge. Riveted Trusses. Design of a Riveted Highway Bridge. Design of Steel Railway Bridges.

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On a multitude of jobs the country over they are opening the eyes of contractors to mixing economy, here's why:

RANSOME'S BANTAM with 10-ft. capacity does away with bag splitting. Yet, the machine weighs but little more than most 5 or 6-ft. mixers—and its price is no higher.

SPECIFICATIONS

Capacity, 1 bag batch up to 1-3-6.
Horsepower, 3.
Height of feed platform, 27 inches.
Weight without runways or platform, 2,275 lb.
Weight with platform and runways, 2,700 lb. Height of discharge, 26 inches.
Thickness of drum shell, No. 10 gage.
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Self-oiling rollers.
Wheels, 20x3 inches.
Price means complete machine with platform and runways.

You *think* it the mixer for your use? You'll be *sure* when you've seen it in actual operation. Ask us to tell you where to find one.

Ransome Concrete Machinery Company

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Chicago Office—605 So. Dearborn St.

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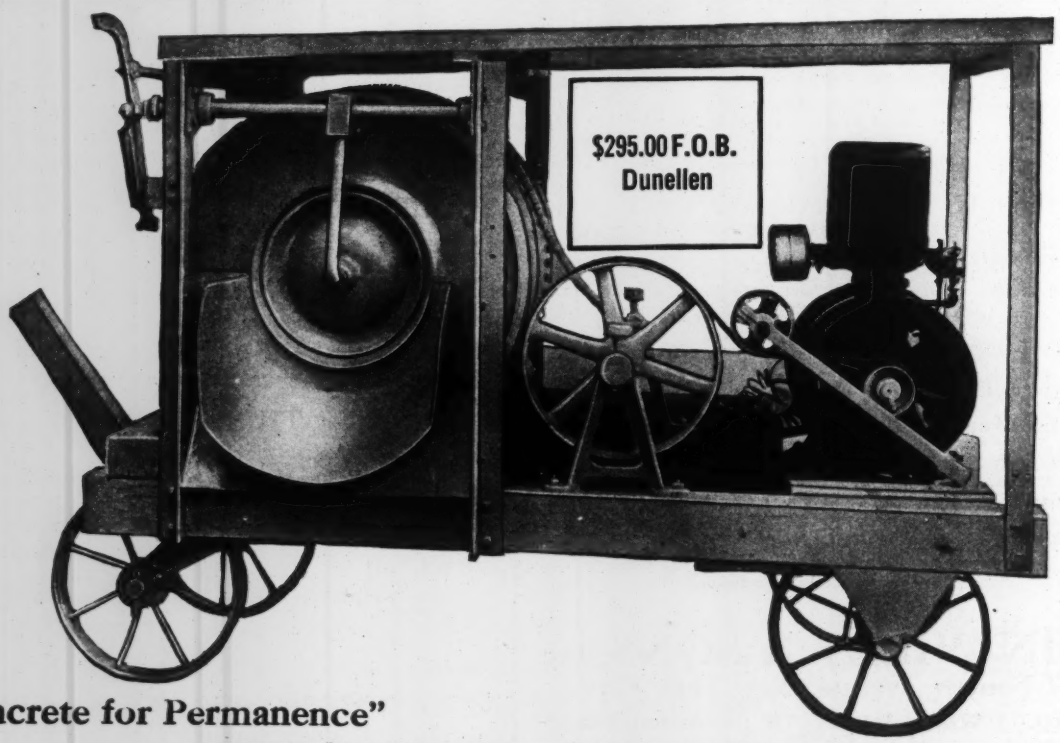

"Concrete for Permanence"

We want a live man as agent in every live town. Write us.

Hitting the Bull's-eye in Concrete Floor Construction

Master Builders Method, with Master Builders Concrete Hardner, has been *hitting the bull's-eye* in concrete floor construction for a good many years—it is the *pioneer* in the hardner field—as *18,000* users, with more than *50,000,000* sq. ft. in daily use, attest.

There must be a mighty good reason why this is true—and there is! Architects, engineers and contractors are hard-headed business men. They are not in the habit of adding something in their construction work for the mere sake of having it there.

When *good* sand and *good* cement, in correct proportions and properly mixed, are used for a concrete floor, they will make a good concrete floor. *Until Master Builders Method was devised* it was the best floor, for many purposes, that could be laid.

But the introduction of Master Builders Method, with Master Builders Concrete Hardner, was to concrete floor construction what the introduction of vanadium was to steel. From a good floor, the concrete floor became a *better* floor—a *super-concrete* floor, if you please.

This result was due to one thing. The addition of Master Builders Concrete Hardner, when applied according to the Master Builders Method, gave the combination of sand and cement a *greater density*, by *closing* and *preventing* the pores with a material *harder* than either, so that the concrete was *better able* to withstand *wear*.

In accomplishing this very desirable result, these *added advantages* naturally accrued—the *elimination of dust* and the *prevention of water absorption*. Thus came into universal adoption and use the *Wearproof*, *Waterproof* and *Dustproof* concrete floor—the floor known today *throughout the world*, wherever building operations of any importance are carried on, as the Master Builders *Masterbuilt* floor.

To Be Informed Is To Be Prepared—

It is highly important that you *analyze* and *understand* this *better* concrete floor construction if you have not yet thoroughly investigated it. It means *much* to your clients; it means *even more* to you. The coupon will bring an interesting folder, "The City Master Builders Built," with other informative and technical matter, including our famous "Primer," the authoritative manual of concrete floor work. *Sign* and *mail* it now and get this valuable data *free*.

THE MASTER BUILDERS COMPANY

Makers of Master Builders Concrete Hardner, Master Builders Red Concrete Hardner, Master Builders Black Concrete Hardner, Roadyte—Concrete Hardner for Concrete Roads, Sanlseal Liquid Concrete Hardner.

Main Office and Works: Cleveland, Ohio

Branches in all important cities

The Master Builders Company,
Cleveland, Ohio.

I wish to be further informed on Master Builders Method and Master Builders Concrete Hardner. Send me your literature.

Name.....

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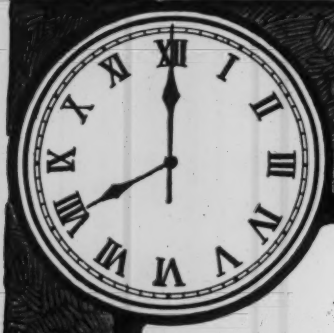

TESTS EVERY HOUR DAY AND NIGHT

Uniformity

is a prime requisite of cement. When the proportions for the concrete have been fixed upon, it is necessary that every bag of the cement used be up to the high standard of quality. One weak spot in the concrete structure might prove to be serious.

The uniformity of ALPHA CEMENT is safeguarded by systematic testing which begins with quarry borings. These tests by expert chemists are applied hourly at every ALPHA plant. The ALPHA policy is to make its chemists men of real authority. Their decisions as to quality are absolute. The result is that it is impossible for any cement that will not set properly to be shipped from an ALPHA plant. Every bag is guaranteed—and stamped "Guaranteed"—to invariably meet standard specifications.

Test ALPHA if you prefer, but you don't have to.

Art Envelope No. 7, giving views and data of many distinctive concrete constructions, sent free on request.

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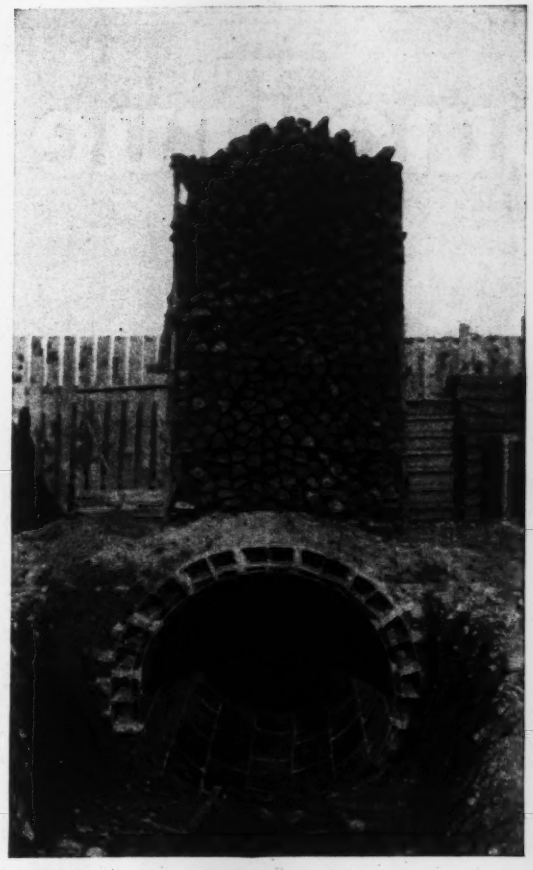
ALPHA
THE HOURLY TESTED AND GUARANTEED PORTLAND
CEMENT



Goodby to the notion that Segment Block is weak!

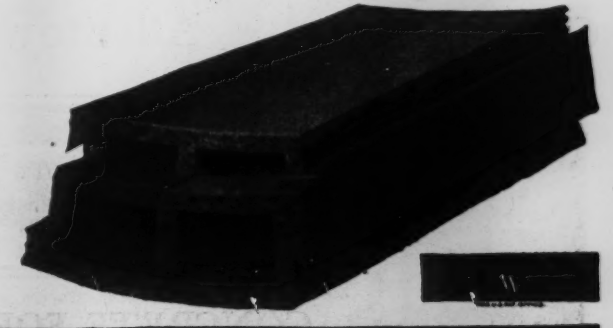
Is a segment block sewer weak? Liable to collapse? AMCO isn't, that's sure! Here are just two of the many tests that prove conclusively the rigid character of AMCO construction:

Picture to left shows a test in Brooklyn. A 50,000 lb. stock of iron pigs on **four lineal feet** of 60-in. AMCO Sewer. No distortion—and no cracks between blocks—found after two weeks.

Picture to right shows test in Cincinnati, conducted by the Department of Sewage, City of Cincinnati. This short length of AMCO was loaded with 65,000 lb. Practically no distortion or deflection after **two** days. City Engineer Morse says "The results were unexpectedly favorable to this type of construction."

Yes, AMCO is rapidly dispelling the notion that a segment block sewer is lacking in adequate rigidity.

Ease of construction—light weight—rigidity—glasslike surface that stays so—permanently smooth flow line—this is AMCO. Engineers—this sewer means satisfaction to you. Contractors—this sewer means profit to you. Why not investigate? Get our book of tests.



American Sewer Pipe Co.

General Offices: Akron, Ohio

Twenty-Six Plants Throughout the U. S. A.

The Lehigh Way

The former work of a lifetime is concentrated in a few short months—the realization of plans and hopes is made permanent—by concrete. Concrete satisfaction can be assured by careful choice of the materials used.

Lehigh Portland Cement Company

Chicago, Ill. Allentown. Pa. Spokane, Wash.

LEHIGH CEMENT

CONCRETE FOR PERMANENCE

Who Buys the PULSOMETER?

We're continually hammering on the fact that the PULSOMETER pumps up to 50% solid matter, that it NEVER needs lubrication, NO skilled operator, NO special boiler, NO foundation.

Who acts on these facts — Who, **ouys?** An answer to tnis question is the following list of **some** of the orders we have received in the past month.

Note the Bradstreet financial rating of the concerns.

U. S. Aluminum Company (rating GAa)—One No. 7 PULSOMETER, ordered by wire.

Pittsburgh Steel Ore Company (rating GAa) — one No. 8 PULSOMETER with clapper valve, ordered by wire.

U. S. Cast Iron Pipe & Foundry Company (rating GAa)—one No. 8 PULSOMETER, ordered by letter.

The Texas Company (rating GAa)—one No. 4 PULSOMETER, ordered by letter.

Stauffer Chemical Company (rating GAa)—one No. 2 PULSOMETER, ordered by telephone.

Shewan Tomes & Company (rating GAa)—one No. 5 PULSOMETER, ordered by letter.

Blome Sinek Company (rating K-B)—one No. 5 PULSOMETER and extra fittings. Ordered by letter.

Menasha Printing Company (rating M-A)—one No. 4 PULSOMETER, ordered by letter.

Bailey-Lebby Company (rating O-B)—one No. 6 PULSOMETER, ordered by wire.

A. J. Smith Construction Company (rating Q-B)—one No. 5 PULSOMETER, ordered by wire.

U. S. Government Engineers Office—one No. 7 PULSOMETER, ordered by letter.

In addition to above there were 17 other pumps sold in May, 1916, by agents whose names are given below.

The Leading Concerns of the Country Do. And they Keep Buying!

Most of the above concerns have already used the PULSOMETER for years, so that these orders are "repeats." But it gives you an idea who's buying. Why not investigate this pump? If you buy one, you'll wonder how you ever did without it.

Pulsometer Steam Pump Co.

General Offices & Works: 486 South 21st Street, Irvington, N. J.
N. Y. Office: 35 Thomas St.
Chicago Office: 930 Lytton Building
St. Louis Office: 1440 Syndicate Trust Building

Pulsometers Carried in Stock by the Following Agents

Harold L. Bond Co.	391 Atlantic Ave., Boston, Mass.
Haubtman & Loeb Co.	717 Magazine St., New Orleans, La.
Harron, Rickard & McConc	139 Townsend St., San Francisco, Calif.
Harron, Rickard & McCone	164 N. Los Angeles St., Los Angeles, Calif.
Miller Supply Co.	Huntington, W. Va.
Queen City Supply Co.	S. W. Cor. Elm and Pearl Sts., Cincinnati, O.
Somers, Fitler & Todd Co.	323 Water St., Pittsburgh, Pa.
The Wheland Co.	Chattanooga, Tenn.
V. H. Kreighaber & Co.	Atlanta, Ga.
Pocatello Eng. & Mach. Co.	129 So. Main St., Pocatello, Idaho
H. A. Paine	Houston, Texas
A. R. Williams Machinery Co.	Toronto, Ont., Canada
F. H. Hopkins & Co.	Montreal, Quebec, Canada
Henry H. Meyer Co.	110 So. Howard St., Baltimore, Md.
Standard Supply & Equipment Co.	13th and Cherry Sts., Philadelphia, Pa.
Wm. H. Zeigler	320 Temple Court, Minneapolis, Minn.
Thos. L. Barrett	27 No. 3rd St., Louisville, Ky.

Sanitation R-W Process

The R-W Screen in action—note solids being removed by revolving brushes above sewage flow.

To the right are the salient features that make for the success of the Sanitation R-W Process whether used for treatment of sewage or clarification of trade wastes.

Our large Bulletin G-3 takes up the various points thoroughly and will prove very interesting to engineers engaged in this work. A copy at your request.

1. Immediate treatment of fresh sewage.
2. Instantaneous removal of solids —heavy light, or floating, and true suspended matter.
3. May be set in existing sewer line — small space required.
4. A large variation in flow levels permissible—will work against tidal conditions.
5. Effective screen seal insures treatment of entire flow—no disintegration of solids.
6. Four-fifths of screen in service under water—solids removed from screen above sewage level.
7. Low velocity of travel of screen through sewage.
8. Clean, noiseless—no corners in screen chamber for accumulations.
9. Efficient, non-septic, unless the influent is septic, then septicization is not advanced in treatment.
10. High by-product values recovered.
11. Low operating and maintenance costs.
12. Low initial cost.

THE SANITATION CORPORATION

Apparatus, Equipment and Complete Plants for Sewage Disposal

50 CHURCH STREET - - - NEW YORK CITY

Construction News

RAILWAYS—STEAM AND ELECTRIC

Proposed Work

New York—Buffalo Southern Ry., Buffalo, applied for franchise to extend line through additional streets in Hamburg. F. Wing, Buffalo, Ch. Engr.

New Jersey—Central R.R. of New Jersey plans 2 additional tracks through Bayonne. J. O. Osgood, New York, N. Y., Ch. Engr.

New Jersey—(Official)—A. D. Snelbaker, Woodstown, interested in railway from Pennsgrove to Atlantic City. Augustus Clark Seward, Vineland, Consult. Engr.

Pennsylvania—M. S. Hershey Chocolate Co., Hershey, surveying for railway from Manheim through Lebanon County via Union Square, Mastersonville, Mt. Gretna, Colebrook Lawn and Bachmansville.

Pennsylvania—Lehigh & New England R.R. making surveys for line from Bath via Chapman Quarries to Benders Junction, 8 mi. R. H. Wilbur, Philadelphia, Gen. Mgr.

Pennsylvania—McConnellsburg & Ft. Loudon Railroad Co., Franklin, recently organized, granted charter for line from Franklin to Fulton, 10 mi. J. P. Sipes, McConnellsburg, Pres.

Pennsylvania—Pennsylvania R.R. asked Public Service Commission of Pennsylvania for permission to change main line through Sewickley and Edgeworth to enable tracks to run along bank of Ohio River. Estimated cost, $1,000,000. A. C. Shand, Philadelphia, Ch. Engr.

Pennsylvania—West Penn Traction Co., Pittsburgh, plans extension to Dunbar via South Connellsville. W. E. Moore, First National Bank Bldg., Pittsburgh, Gen. Mgr.

Maryland—United Railways and Electric Co., Baltimore, applied for franchise to double-track portion of Liberty Heights Ave. T. A. Cross, Continental Bldg., Gen Mgr.

Florida—Central Florida Interurban Railway Co. incorporated with $100,000 capital and plans about 300 mi. of railway. W. S. Alyea, Secy.

Tennessee—Nashville—Gallatin Interurban Ry. securing right-of-way for line from Edenwold to Springfield, 18.4 mi. R. A. Bailey, Jr., Nashville, Gen. Mgr. Noted Jan. 20.

Ohio—Ohio Electric Ry., Dayton, granted franchise for 1 mi. track on 4th St. A. Benham, Springfield, Gen. Mgr.

Illinois—Chicago Surface Lines, Chicago, granted franchise for lines on Canal St. and Lake Park Ave. H. B. Fleming, First National Bank Bldg., Ch. Engr.

Wisconsin—Capital Interurban Co., Madison, incorporated for interurban railway between Madison and Janesville. G. Pickhardt, interested.

Wisconsin—Chicago & Northwestern Railway Co. plans 9 mi. railway in Oconto and Langdale Counties, Madison. W. H. Finley, Chicago, Ill., Ch. Engr.

Wisconsin—Ettrick Ry. made surveys for line from Blair to Ettrick, 12 mi. George Bradish, La Crosse, Engr. Noted Sept. 9 and Oct. 14.

Wisconsin—Great Northern Ry. plans car yard for 1,000 cars, also coaling station, etc., at Superior. A. H. Hogeland, St. Paul, Minn., Ch. Engr.

Minnesota—Great Northern Ry. plans yard for 2,000 cars at Northtown near Minneapolis to cost $220,000, coaling stations and engine facilities at Sandstone, Ihlen, Willmar and Breckenridge and various other points, to cost $1,000,000, 4,573 ft. of timber bridges replaced with steel and 3,576 ft. with concrete. A. H. Hoagland, St. Paul, Minn., Ch. Engr.

North Dakota—Great Northern Ry. extends line west from Wild Rose, 36 mi. Estimated cost, $750,000. A. H. Hogeland, St. Paul, Minn., Ch. Engr.

Oklahoma—Missouri Pacific Railway System plans line from Bartlesville to Pawhuska. E. A. Hadley, St. Louis, Mo., Ch. Engr.

Washington—Spokane & Inland Empire R.R. granted franchise to extend line on Grand Blvd., Spokane. A. M. Lupfer, Portland, Ore., Ch. Engr.

California—San Pedros, Los Angeles & Salt Lake R.R., Los Angeles, will spend about $1,350,000 for improvements, including new rail and bridges. A. Maguire, Los Angeles, Ch. Engr. of charge of valuation.

Ontario—Sandwich, Windsor & Amherstburg Ry., Windsor, plans ½ mi. of single track with double track on portion of London St., Windsor. James Anderson, Windsor, Gen. Mgr.

Bids In and Contracts Awarded

Montana—Great Northern Ry. awarded contract for 1 mi. extension from Butte to Choteau-Bynum branch in Teton County to be known as Great Falls & Teton Ry. to A. GUTHRIE & CO., St. Paul, Minn. A. H. Hogeland, St. Paul, Minn., Ch. Engr. Noted June 22.

Oklahoma—Wichita Falls & North Western Ry. awarded contract for about 45 mi. railway in Buffalo to J. L. TOBEY & CO., Terrell, Tex. W. A. Webb, Dallas, Tex., Gen Mgr.

LIGHT, HEAT AND POWER

Proposed Work

N. H., Milton—I. W. Jones, Engr., preparing plans for 1-story power plant. Estimated cost, $100,000.

N. J., Pennsville—Salem-Pennsgrove Traction Co. plans power house. Stern & Silverman, Engr.

N. J., Vineland—City preparing plans for addition to power house. Estimated cost, $70,000. Walter Dalton, Heed Bldg., Philadelphia, Penn., Engr.

Penn., Chester—Beacon Light Co. preparing plans for 1-story power house. Estimated cost, $1,000,000. J. T. Windrim, Commonwealth Bldg., Philadelphia, Arch. James H. Denis, Chester, Ch. Engr.

Penn., Treverton—Board of Trade plans to install street-lighting system.

Md., Baltimore—Consolidated Gas and Electric Co. preparing plans for 1-story power plant. Estimated cost, $10,000.

Va., Narrows—Narrows Light and Power Co. plans hydro-electric plant at Narrows Falls on New River.

N. C., Dunn—See item under "Water Works."

N. C., Kernersville—See item under "Water-Works."

N. C., University—See item under "Water-Works."

Ga., Cordele—City votes Aug. 3 on $50,000 bonds for electric-light and power plant. C. F. Wagner, City Engr. Noted May 18.

Ohio, London—City plans to improve electric-light plant.

Ohio, Lorain—National Tube Co. plans power plant.

Ind., Indiana Harbor—Mark Manufacturing Co. plans power plant. Clayton Mark, Dempster and Dobb St., Evansville, Ill., Pres.

Mich., Cadillac—Cadillac Machine Co. having plans prepared for power plant. B. E. Parks & Son, Engr.

Wis., Monticello—(Official)—Village Trustees receiving bids July 13 for generating equipment. Henry M. Marty, Village Clk. Harrison A. Smith, Vroman Bldg., Madison, Engr.

Minn., Red Wing—Board of Education receiving bids July 12 for boiler house. A. E. Lindgren, Secy.

Kan., Almena—City plans to rebuild electric-light plant.

Kan., Ellis—City plans improving generating plant. Estimated cost, $5,000. R. L. Payne, City Clk.

Kan., Hesston—Commercial Club plans electric-lighting system.

N. D., Lankin—City plans election to vote on bonds for electric-light plant.

N. D., Neche—H. R. Robowski, Cherokee, Iowa, granted franchise for electric-light plant.

Mont., Hysham—City voted bonds for electric-light plant and water system. Noted Apr. 27.

Mo., St. Joseph—City plans $745,000 bond issue, $85,000 to be used for improving municipal electric-light plant. C. P. Hoff, City Engr.

Ark., Stuttgart—See item under "Water-Works."

Okla., Dundee—See item under "Water-Works."

Okla., Hanna—Canadian Valley Ice, Light and Fuel Co. granted franchise for electric-light plant. Noted June 1.

Ariz., Phoenix—City votes Oct. 3 on $600,000 bonds for municipal electric-light and gas plant. J. B. Girard, City Engr. Noted June 8.

Calif., San Bernardino—Fontana Development Co., Fontana, plans power plant at mouth of Lytle Creek Cañon. Estimated cost, $350,000. A. B. Miller, Pres.

Ont., Warwick—City Council plans hydro-electric power plant.

Bids In and Contracts Awarded

Mass., Lowell—Lowell Electric Light Corporation awarded contract for power house to STONE & WEBSTER ENGINEERING CO., 147 Milk St. Boston.

N. Y., Ithaca—New York State College of Agriculture, Cornell University, received bids June 15 for heating work, new underground conduits, etc., from Merrill Co., Boston, Mass., $21,500; George H. Drake, Buffalo, $28,989; John W. Danforth Co., Buffalo, $25,747. Noted June 1.

N. Y., New York—(Borough of Brooklyn)—Low bids received June 21 for heating and ventilating work at Kings County courthouse, Fulton and Livingston St., as follows: Callahan, Kingsley Co., 343 West 52nd St., Manhattan, $74,450; Wells & Newton Co., $75,400; James H. Merritt & Co., $74,968. Noted June 15.

N. J., Trenton—(Official)—State Hospital awarded contract for power plant to DEKIMPE BROS., Hoboken, at $25,800. Noted Apr. 6.

Penn., Greenville—Mercer County Light, Heat and Power Co. awarded contract for power station to HANSCOM CONSTRUCTION CO. Estimated cost, $100,000. Noted June 8.

Penn., Harrisburg—Polk Institute awarded contract for power house to C. F. HAMILTON, at $33,217.

Ky., Hazard—Kentucky Power Co. awarded contract for power plant to C. E. CARLIN, Welch, W. Va. Estimated cost, $200,000. H. W. Sanders, Welch, W. Va., Ch. Engr. Noted Apr. 20.

Mich., Sault Ste. Marie—Michigan Northern Power Co. awarded contract for completing repairs to power house to FOUNDATION CO., 233 Broadway, New York, N. Y.

Mich., Three Rivers—City awarded contract for power plant to B. DOUGLAS CO., Ann Arbor.

Neb., Syracuse—Contract awarded for electric-light plant to ALMO ENGINE AND SUPPLY CO., Omaha. Estimated cost, $12,000. Noted Apr. 27.

Neb., Trenton—Village awarded contract for electric-light system to McGRAW CO., Omaha, at $5,246. Noted June 15.

Calif., Oakland—Chevrolet Motor Co. awarded contract for 1-story boiler house at plant on Foothill Blvd. to W. E. WOOD, Detroit, Mich., at $10,000.

BRIDGES

Proposed Work

N. Y., Binghamton—City plans concrete bridge at Washington St. John A. Gitel, City Engr.

N. J., Newark—Erie R.R. plans bridge over Passaic River. Plans approved by War Department. R. S. Parsons, New York, N. Y., Ch. Engr.

Penn., Beaver—(Official)—Beaver County, Beaver, and Allegheny County, Pittsburgh, receiving bids July 7 for county line bridge over Reardon's Run. J. G. Chalfant, Room 308, Court House, Pittsburgh, Engr. of Allegheny County.

Penn., Easton—(Official)—Northampton County receiving bids July 14 for County Bridge No. 183 over Indian Creek. G. P. F. Young, Easton, Controller.

Penn., Kittanning—(Official)—Armstrong County receiving bids July 8 for steel bridge over Cowanshannock Creek in Cowanshannock Township and 1 over northern branch of Plum Creek in Plum Creek Township. F. M. McElwain, Kittanning, Clk.

Md., Ellicott City—Maryland State Roads Commissioners, 601 Garrett Bldg., Baltimore, receiving bids July 5 for bridge on Clarksville Pike between Ellicott City and Elioak.

Va., Hillsville—Carroll County receiving bids July 8 for 81-ft. bridge over Snake River. Address Clerk, Hillsville.

Ga., Atlanta—City plans to repair Edgewood Ave. Bridge. Estimated cost, $10,000. G. E. Kauffman, City Engr.

Fla., Miami—Dade County voted $35,000 for bridges. S. A. Belcher, Chn. Comrs. Noted Apr. 13.

Fla., Titusville—Brevard County voted bonds for bridge to connect Merritt Island with mainland. Address County Clerk, Titusville.

Miss., Booneville—County Supervisors receiving bids July 3 for bridge across Mackey's Creek on Marietta and Allens Store Rd. C. R. Lacey, Booneville, Clk.

Miss., Charleston—Tallahatchie County receiving bids July 3 for iron bridge across Tallahatchie River. D. S. Henderson, Charleston, Clk.

Tenn., Knoxville—Knox County Good Roads Commission receiving bids July 5 for concrete bridge over Roseberry Creek on Washington Rd.

Ky., Bedford—Trimble County receiving bids July 3 for purchase of $45,000 bonds for bridges and roads. O. S. Joyce, Bedford, Clk. Noted June 8.

Ohio, Akron—Montgomery County plans concrete viaduct across canal west of James St. Estimated cost, $50,000. Address County Clerk, Akron.

Ohio, Akron—City will vote August on bonds for North Hill Viaduct. Estimated cost, $1,350,000. J. A. Gehres, City Engr.

Ohio, Akron—Summit County receiving bids July 10 for bridge in South Main St. Extension, Coventry Township. U. G. High, Clk.

Ohio, Chillicothe—Ross County plans 4 bridges. G. Perry, Chillicothe, County Surv.

Ohio, Cincinnati—Hamilton County receiving bids July 7 for extending culvert No. 1, Delhi Township. Albert Reinhardt, Cincinnati, Clk.

Ohio, Eaton—County awards contract for bridge work about July 15. Estimated cost, $8,600. Address County Clerk, Eaton.

Ohio, New Paris—Preble County plans 20 bridges. O. Hecthorn, Eaton, County Engr.

Ohio, Sandusky—City plans 4 mi. bridge over Sandusky Bay from Sandusky to Marblehead Peninsula. Estimated cost, $1,000,000. R. L. Wager, City Engr.

Ind., Hammond—City plans steel or concrete bridge over Grand Calumet River on Calumet Ave.

Ind., Jasper—County receiving bids July 3 for 170-ft. concrete bridge over Patoka River. J. H. Seng, Jasper, Audr.

Ill., Lewiston—State Highway Department, Springfield, receiving bids July 5 for steel bridge on Route 5 in Fulton County. Estimated cost, $6,910.

Ill., Pekin—(Official)—City receiving bids July 1 for bridge work in Groveland Township.

Ind., Rockport—J. Frank Stocking, Audr., Rockport, receiving bids July 2 for 29 bridges in Spencer County.

Wis., Rice Lake—City receiving bids about July 1 for 270 ft. reinforced-concrete bridge across Red Cedar River on Main St. J. H. A. Brahtz, Mankato, Minn., Consult. Engr. Noted Apr. 6 and May 25.

Iowa, Independence—(Official)—E. A. Bordner, County Audr., Independence, receiving bids July 3 for construction 12 bridges.

Iowa, Marshalltown—A. W. Dobson, County Audr., Marshalltown, receiving bids July 6 for constructing 30 bridges. Estimated cost, $30,000. H. O. Hickok, Engr.

Minn., Aitkin—(Official)—Aitkin County plans 210-ft. truss and beam span bridge. Address County Clerk, Aitkin.

Minn., Buffalo—Wright County receiving bids July 11 for pile bridge. Address County Clerk, Buffalo.

Minn., Hastings—City receiving bids July 6 for 120-ft. steel bridge. R. M. Alexander, City Clk.

Minn., Madison—City receiving bids July 3 for steel and concrete bridge. H. F. Nerge, City Clk.

Kan., Jerome—Gove County receiving bids July 3 for 2 3-span steel bridges and 1 concrete bridge across Smoky River. S. A. Mitchell, Jerome, Clk.

Kan., Manhattan—Riley County receiving bids July 12 for bridge across Blue River. W. S. Gearhart, State Engr. Noted Apr. 27 and May 25.

Kan., Phillipsburg—Phillips County receiving bids July 19 for steel truss bridge near Long Island and 4-span reinforced-concrete bridge near Glade. W. W. Warner, Phillipsburg, Clk.

N. D., Wahpeton—Richland County receiving bids July 11 for steel bridge across Bois de Sioux River. F. A. Burton, Wahpeton, Audr.

Mont, Columbus—County receiving bids July 3 for 3 steel highway bridges. L. B. Barley, Columbus, County Clk.

Mont., Dillon—Beaver Head and Silver Bow Counties plan bridge across Big Hole River. Estimated cost, $12,000. Address County Clerk, Dillon.

Mo., Linens—Linn County receiving bids July 10 for 13 steel bridges. J. B. Rogers, County Engr.

Mo., Sedalia—Sedalia Twelve Mile Road District receiving bids July 8 for 5 reinforced-concrete bridges. C. A. Thomas, Supt.

Mo., Springfield—John R. McAfee, Springfield, County Engr., preparing plans for bridges in Greene County. Noted June 15.

Ark., Benton—County plans bridge across Saline River. Estimated cost, $5,000. Address County Clerk, Benton.

Tex., Belton—Citizens vote July 19 on $6,000 bonds for bridges and other improvements in Dennis Mill District. Address County Clerk, Belton.

Tex., Huntsville—Walker and Trinity Counties preparing plans for bridge across Trinity River between Huntsville and Trinity. Estimated cost, $75,000. Address County Clerk, Huntsville. Noted Nov. 18.

Tex., Riverside—C. M. McKinion, Groveton, and W. A. Leigh, Huntsville, receiving bids July 10 for bridge across Trinity River at Riverside. Noted Dec. 30.

Okla., Holdenville—Hughes County votes July 18 on $50,000 bonds for bridge across Canadian River. C. M. Lawrence, Holdenville, County Engr. Noted June 8.

Colo., Burlington—Kit Carson County receiving bids July 7 for bridge over Republican River. O. P. Beidelman, Burlington, Clk.

Ariz., Holbrooke—Board of Supervisors receiving bids July 1 for 7 bridges. Dee M. Moss, Clk. Noted Mar. 23.

Wash., Spokane—Leonard Funk, Comr. Pub. Wks. receiving bids July 6 for rebuilding 3 steel bridges, to cost $27,000, reinforced-concrete bridge over Spokane River, $100,000 and concrete bridge and viaduct over Spokane River and Great Northern Ry., $135,000. M. Macartney, City Engr.

Calif., Bakersfield—County receiving bids July 6 for pile bridge over Buttonwillow Slough. Address County Clerk, Bakersfield.

Calif., Ventura—Board of Supervisors receiving bids July 7 for La Crosse bridge across San Antonio Creek. J. B. McCloskey, Clk. Noted Apr. 20.

Bids In and Contracts Awarded

Conn., Bridgeport—City awarded contract for repairing Yellow Mill Bridge to TOOLE & SUNDERLIN, Bridgeport, at $8,751.

N. H., Enfield—(Official)—City awarded contract for bridge to UNITED CONCRETE CO., Albany, N. Y. Noted June 15.

Conn., Derby—State Highway Commission, Hartford, received bids for bridge across Housatonic River between Derby and Shelton as follows: Arthur McMullen, 149 Broadway, New York, N. Y., $10,057; C. W. Blakeslee & Sons, 58 Waverly St., New Haven, $13,064; Lathrop & Shea Co., 185 Church St., $22,569. Noted Feb. 14 and June 1.

Conn., New London—County awards contract for 600-ft. highway bridge across Niantic River some time in August. Estimated cost, $75,000. Yates & Yates, 120 Broadway, New York, N. Y., Consult. Engr. Noted May 11.

N. Y., New York—(Borough of Manhattan)—(Official)—U. S. Wood Preserving Co. submitted lowest bid for furnishing and delivering creosoted wood blocks to Department of Bridges at $39,824 for water gas oil treatment, of $41,440 for heavy oil treatment and $43,776 for light oil treatment. Noted May 11.

N. Y., Perry—(Official)—City received bids for reinforced-concrete viaduct in Borden Ave. over Silver Lake Outlet from A. J. Shaw, Jr., Batavia, $9,712, J. F. Leary Construction Co., Rochester, $10,290, and Warsaw Construction Co., Warsaw, $11,261. Noted May 11 and June 8.

N. J., Plainfield—County awarded contract for Westervelt and Raymond Ave. Bridges to A. E. SMITH, Plainfield, at $10,345; Terrell Rd. Bridge to LOGAN CONSTRUCTION CO., 18 Park Row, New York, N. Y., at $5,886. Noted Nov. 4.

N. J., Salem—Salem County rejected bids received June 9 for Penn's Neck Bridge over Salem River. Noted May 25.

N. J., Somerville—County awarded contract for bridge over Peters Brook at Grove St. to SUTTON & ERNST, at $6,800.

N. J., Trenton—Pennsylvania R.R. awarded contract for bridge at Conover's Crossing to J. M. KELLY, Philadelphia. A. C. Shand, Philadelphia, Ch. Engr.

N. J., Woodbury—County awarded contract for bridge between Hurffville and Glassboro to WHITTAKER & DIEHL, Harrisburg, Penn.

Penn., Lewisburg—County rejected all bids received June 17 for girder bridge over Rapid Run.

Penn., Philadelphia—(Official)—Lowest bid received for repairing Rhawn St. Bridge No. 2 over Pennypack Creek was Horseheads Construction Co., Horseheads, N. Y. Noted June 15.

Penn., Philadelphia—(Official)—City awarded contract for bridge on line of Bensalem Ave. over Pennypack Creek, Schedule A, to DAY & ZIMMERMAN, 611 Chestnut St., Philadelphia, at about $200,000. Noted May 18 and June 22.

W. Va., Marlinton—(Official)—Pocahontas County awarded contract for 5 bridges to CONCRETE STEEL BRIDGE CO., Clarksburg, at about $9,000. Noted June 8.

S. C., Haynes—Southern Ry. awarded contract for overhead bridges to J. M. HOBBS, Greensboro, N. C.

Fla., Bradentown—Manatee County awarded contract for bridges in Sarasota-Venice Road and Bridge District to LUTEN BRIDGE CO., York, Penn. Noted Apr. 6 and May 4.

Ky., Albany—County awarded contract for bridge over Spring Creek to OREGONIA BRIDGE CO., Lebanon, Ohio, at $5,994. Noted Apr. 6.

Ind., Boonville—County awarded contract for 19 bridges to VINCENNES BRIDGE CO., Vincennes, at $19,094.

Ind., Evansville—County awarded contract for 30 bridges to A. W. MONTGOMERY, Hatfield, at $12,079.

Ind., Jasper—Dubois County rejected bids received June 7 for bridge. Noted May 25.

Mich., Benton Harbor—(Official)—City awarded contract for bridge on Britain Ave. to ILLINOIS BRIDGE CO., Chicago, Ill., at $20,258. Noted June 1 and 8.

Ill., Chicago—City awarded contract for piles for South Sacramento Bridge to GREAT LAKES DREDGE AND DOCK CO., Chicago, at $1.96 per ft.

Ill., Quincy—(Official)—Low bidder for reinforced concrete box culvert is C. A. Wever & Son, Clayton, Ill.

Wis., Antigo—City awarded contract for 2 bridges to AUGUST MARMES, Antigo.

Wis., Fond du Lac—City awarded contract for 2 bridges to GAFIN & GEHRI, at $5,457 Noted May 18.

Iowa, Iowa City—City awarded contract for bridges across Ralston Creek to ALFRED VINALL, Davenport, at $6,184. Noted June 15.

Iowa, Pocahontas—County awarded contract for 8 bridges to IOWA BRIDGE CO., Des Moines. A. L. Thornton, Pocahontas, County Engr.

Iowa, Sumner—(Official)—Contract for improving bridges near Sumner awarded to FRED BOEDECKER, Readlyn, at $6,250. C. A. Cool, 123 East Bremer Ave., Waverly, Engr. Noted June 15.

Kan., Wichita—Arkansas Valley Interurban Railway Co. awarded contract for bridge across Sand Creek to TOPEKA BRIDGE AND IRON CO., Topeka, at $4,250. Noted June 1.

S. D., Brookings—(Official)—Brookings County awarded contract for bridge work to IOWA BRIDGE CO., Des Moines. Noted May 25.

S. D., Plankington—City awarded contract for bridge to M. GALES, at $7,028.

S. D., Salem—County awarded contract for 8 bridges to W. A. BARNHART CONSTRUCTION CO. J. C. Hinrichs, Salem, County Audr.

Mo., Martin City—Contract for bridge near Martin City awarded to DAVID MONROE, 1118 Walnut St., Kansas City, at $9,062.

Mo., Republic—Missouri, Kansas & Texas Ry. awarded contract for new piers for bridge over Arkansas River to J. W. McMURRAY CONSTRUCTION CO., Kansas City, at $62,000.

Ark., Malvern—Hot Spring County awarded contract for bridge over Ouachita River to ILLINOIS BRIDGE CO., Chicago, Ill., at $9,990.

Tex., Dallas—Lowest bids received for Sec. A of Commerce St. bridges were: R. J. Estep & Co., at $14,751; Hughes-O'Rourke Construction Co., at $15,536; W. C. Hedrick Construction Co., at $18,218. H. Moseley, City Engr.

Tex., Gainesville—Contract for bridge across Red River at Sacras Ferry awarded to CANADIAN RIVER VALLEY BRIDGE AND CONSTRUCTION CO., Oklahoma, Okla. Estimated cost, $60,000. Noted June 22.

Tex., Houston—City awarded contract for Harrisburg Rd. Bridge to E. B. VAN de BREYN, at $35,000.

Okla., Dunlap—Contract for bridge across Beaver River at Dunlap awarded to CANTON BRIDGE CO.

Wash., Davenport—County awarded contract for Morse Bridge to CHARLES G. HUBER, Seattle, at $4,250.

Calif., Modesto—County awarded contract for bridge over Tuolumne River to C. E. COTTON, 16 California St. San Francisco, at $110,278. Noted May 25 and June 8.

Calif., Sacramento—Northern Electric Co. awarded contract for steel bridges to MISSOURI VALLEY BRIDGE AND IRON CO., Leavenworth, Kan.

Calif., San Luis Obispo—San Luis Obispo County awarded contracts for bridge work as follows: GUTLEBEN BROS., 3 bridges, $43,782; GILLAHAN & SONS, 1, $4,000; COLE CONSTRUCTION CO., 1, $5,499; F. MOORE, 1, $4,739; THEODORE MAINO, 1, $7,100; MIDLAND BRIDGE CO., 1, $5,445. Noted June 1 and 22.

Calif., Ventura—Low bidder for south approach to Saticoy Bridge across Santa Clara River is R. M. Davis, Saticoy. Noted June 1.

Man., Russell—(Official)—City awarded contract for bridge to A. S. CABIE, 74 Isabel St., Winnipeg, at $5,284. Noted June 1.

B. C., Victoria—Canadian Northern Pacific Ry. awarded contract for arch over Burnside Rd. to ROBERTSON & PARTNERS, Metropolitan Bldg.

WATER-WORKS

Proposed Work

R. I., Providence—City plans to sell about $1,000,000 bonds for water system. M. H. Bronsdon, Supt.

Mass., Boston—City Council voted $165,000 for high-pressure fire service pumping station and improving old one. G. F. Finneran, Supt. Noted June 22.

N. Y., Batavia—City will vote on $175,000 bonds for water system. Chester & Fleming, Pittsburgh, Penn., Engr. Noted June 22.

N. J., Deal—Shark River Water Co. plans water system to furnish towns from Deal to Point Pleasant.

Penn., Philadelphia—City plans to spend about $25,000 for water meters. A. J. Fuller, Supt.

Del., Wilmington—City receives bids for three 8,000,000-gal. turbine ribbon centrifugal pumps for new reservoir. E. M. Hoopes, Jr., Supt.

N. C., Dunn—City plans to improve water system and electric-light plant. Gilbert C. White, Durham, Consult. Engr. G. K. Granthan, Mayor.

N. C., Kernersville—City voted $10,000 bonds for water and sewer system and electric-light plant.

N. C., Salisbury—Board of Water Commissioners receiving bids July 12 for filtration plant and new water system. J. W. Meade, Supt.

N. C., University—Trustees University of North Carolina will spend $42,000 for water and electric-light system and heating plant. J. B. McCrary Co., Atlanta, Ga., Engr.

S. C., Bamberg—City awards contract for improving water system. Estimated cost, $15,000. G. D. Ryan, Supt. Noted Apr. 20 and May 25.

Ga., Savannah—City plans to improve and extend water system. E. R. Conant, City Engr.

Fla., Jacksonville—City receiving bids July 6 for 1,800 ft of 6-in. Class B, 600 ft. of 8-in. Class D and 24 ft. of 20-in Class C c.-i. pipe, 5 tons Class B fittings and 500 c.-i. meter-box frames and covers. L. E. Murphy, Supt.

Miss., Baldwyn—City receiving bids July 12 for improving water system and electric-light plant. X. A. Kramer, Magnolia, Consult. Engr. Noted Apr. 13 and May 4.

Miss., Cleveland—City will extend water system. Estimated cost, $6,000.

La., Gretna—City will install reservoir and pumping station.

La., Lockport—Town Council receiving bids July 6 for water system.

La., West Monroe—City voted $45,000 bonds for extending water system and electric-light plant. Noted Apr. 6 and 27.

Ohio, Celina—Board of Control plans water-works improvements. Estimated cost, $18,000. Charles H. Grey, Celina, Pres.

Ohio, Columbus—City receiving bids July 7 for furnishing steam turbine, reduction gear driven, centrifugal pumping unit of 25,000,000-gal. capacity, at Sciota River Pumping Station. L. J. Guthke, Secy., Bd. of Pur. J. O'Shaughnessy, Supt.

Ohio, Dayton—City plans rebuilding steel dam. Estimated cost, $20,000. H. Collins, Supt.

Ohio, Middletown—City Commission receiving bids July 5 for water system. S. G. Pollard, Cincinnati, Consult. Engr. John Kunz, City Clk.

Ohio, Rocky River—City receiving bids July 25 for purchase of $10,081 bonds for water mains, etc., in North Ridge Rd. Frank Mitchell, City Clk.

Ohio, Springfield—(Official)—City receiving bids July 3 for 193 tons Class C c.-i. pipe in 12- or 16-ft. lengths and special castings and fittings. George S. Cotter, Supt. and Engr.

Ohio, Struthers—City plans reservoir and dam near Kirkland Farm. Plans being prepared.

Ind., Huntington—City awards contract for deepening 13 wells. John W. Moore, 47 Union Trust Bldg., Indianapolis, Engr.

Ill., Berwyn—Oscar N. Lindahl, Secy. Bd. of Improvements, receiving bids July 11 for water service pipes in Wesley Ave.

Ill., Berwyn—Oscar N. Lindahl, Secy. Bd. Local Improvements, receiving bids July 11 for 12-in. c.-i. water main in 30th St. and Oak Park Ave.

Ill., Murphysboro—Western Gas Co., Aurora, acquired water system and plan to spend $100,000 for improvements. Address H. L. Farrer, Aurora.

Ill., Watseka—City plans pumping plant.

Wis., Altoona—City plans water system.

Iowa, Coin—City will resubmit $12,000 bond issue for water system. Noted Apr. 13.

Iowa, Exira—City having preliminary plans prepared for improving water system. Stevens & Stiles, 222 Commerce Bldg., Kansas City, Mo., Engr.

Iowa, Volga—Citizens will vote on bond issue for water-works system. Noted June 8.

Iowa, Waverly—(Official)—City does not plan new water mains as stated in issue of June 15. H. R. Van Derveer, City Clk.

Kan., Osage City—H. W. Underhill, Arch., 416 Bryant Bldg., Kansas City, Mo., preparing plans for water house and power plant. C. O. Greenstreet, Water-Works Supt.

Kan., Wetmore—City plans water system.

Neb., Auburn—City voted $9,000 bonds for water system.

Neb., Fairbury—City plans to improve water system. G. D. Myers, Supt.

S. D., Boland—City receiving bids July 5 for purchase of $6,000 bonds for water system. P. L. Brown, Audr.

N. D., Harvey—L. W. Miller, City Audr., receiving bids July 3 for water connections and laying water pipes. C. R. Cummings, Supt.

Wyo., Riverton—(Official)—City receiving bids July 6 for improving water system. Estimated cost, $10,000. A. Boland, Supt. Noted June 1 and 15.

Mont., Glasgow—City voted $26,700 bonds for water system. A. J. Melvin, Supt.

Mont., Hysham—See item under "Light, Heat and Power."

Mo., Paris—City plans filtration plant. Estimated cost, $12,500. G. B. Blakey, Supt.

Ark., Stuttgart—City granted F. G. Prout franchise for water system and electric-light plant. Noted Oct. 14.

Tex., Lyford—A. D. Struthers and associates received franchise for water-works.

Okla., Broken Bow—City plans water-works system. Address City Clerk.

Okla., Dundee—City plans water-works and natural-gas plant.

Okla., Eufaula—City voted $25,000 bonds for improving water system. M. Smith, City Engr. Noted June 1 and 15.

Okla., Hitchcock—City plans water system.

Nev., Lovelock—County Commisioners, Winnemucca, receiving bids July 15, for distributing reservoir and pipe system. L. H. Taylor, Lovelock, Engr. Noted Feb. 10.

Ariz., Bouse—New La Pax Gold Mining Co. plans 1,750,000-gal. reservoir.

Wash., Seattle—City Council adopted resolution to lay water mains in portion of North 59th and McClellan St. L. B. Youngs, Supt.

Ore., Merrill—City voted $6,000 bonds for water system. Noted May 4.

Calif., Lindsay—C. W. Wright, Secy. Lindsay-Strathmore Irrigation District, receiving bids July 7 for improving water-works system. R. N. Graham, Mayor.

Calif., Woodland—City will soon award contract for water system. Estimated cost, $55,000. G. E. Whitney, City Clk. Noted Apr. 20 and June 1.

Ont., Toronto—City receiving bids July 4 for 8-in. water meters.

Sask., Saskatoon—City receiving bids July 13 for water main under river. C. I. Yorath, City Comr. Noted Apr. 20.

Bids In and Contracts Awarded

Mass., North Easton—(Official)—Contract for 2⅝ mi. 6 and 8-in. water pipe awarded to G. FERULLO & CO., 31 North St., Boston. Noted June 15.

Mass., Pittsfield—City will lay water mains by day labor. Estimated cost, $17,000. J. Wise, Supt. Noted June 8.

N. Y., North Tonawanda—City awarded contract for 12,000,000-gal. water pump to ALLIS-CHALMERS CO., New York, N. Y., at $29,000.

N. J., New Brunswick—City awarded contract for motor-driven centrifugal pumps to NEW YORK CONTINENTAL JEWELL FILTRATION CO., 15 Broad St., New York, N. Y., at $8,550. Noted June 1.

N. J., Trenton—(Official)—New Jersey State Hospital awarded contract for extending fire-service pipe system to PIPER BROS., Trenton, at $16,990. Noted June 8.

Penn., Lockhaven—City awarded contract for portion of storage dam No. 1 to B. H. CORYELL, Williamsport.

Penn., Pittsburgh—City awarded contract for water meters to GAMON WATER METER CO., Newark, N. J., at about $70,000. Noted June 1 and 8.

Ga., Waycross—City awarded contract for water system to PARK-MORRAND CO., Waycross.

S. C., Newberry—City awarded contract for wells to HUGHES SPECIALTY WELL DRILLING CO., 96 Ashley Ave., Charleston.

Fla., Miami—Contract awarded to J. P. LITTLE, West Palm Beach, at $29,163, for water mains and sewers. Noted May 25.

Ohio, Chardon—Contract for water-works system awarded to F. R. GRAVETT and T. W. MORGAN, at $57,604. Noted June 8.

Ind., Jasper—City awarded contract for filtration plant to INTERNATIONAL FILTER CO., at $5,484. Noted June 8.

Mich., Calumet—City awarded contract for water system to H. STENSRUD, Marquette.

Mich., Detroit—(Official — Fire Commission awarded contracts for pipe line as follows: FLOWER-STEPHENS MANUFACTURING CO., Detroit, hydrants, $55 each, gate valves, $12; DETROIT LEAD PIPE WORKS, boxes, $2.80; AMERICAN CAR AND FOUNDRY CO., pipe, $30 per ton, fittings, $3 cwt. Noted June 15.

Ill., McKeesport—(Official)—City awarded contract for pipe line to MONONGAHELA & OHIO DREDGING CO., Pittsburgh, Penn.

Wis., Sheboygan Falls—City awarded contracts for water system as follows: E. M. SCHEFLOW, Elgin, Ill., excavation and labor, $7,963; JAMES B. CLOW & SON, Chicago, Ill., c.-i. pipe, $12,419; KISPERT & McCARTHY, Kaukauna, well, $2,021; CHICAGO BRIDGE AND IRON WORKS, Chicago, Ill., tank, $4,100; KEYSTONE DRILLING CO. Chicago Ill., pump, $2,060. Noted Mar. 30.

Iowa, Cherokee—City awarded contract for water mains to SWANSON & BETHSWORTH.

Iowa, Palmer—City awarded contract for water system to DES MOINES BRIDGE AND IRON WORKS, Des Moines, at $5,050.

Minn., Hayward—City awarded contract for water tank to POLLACK & POLLARD, Minneapolis, at $11,000.

Minn., Highland—Contract for 180,000-gal. reservoir for Duluth & Iron Range R.R. awarded to STROM BROS., Two Harbors.

Minn., Lake Crystal—Contract for water-works system awarded to ARTHUR N. DOBSON & CO., Lincoln, Neb.

Neb., Alliance—(Official)—City awarded contract for extending water mains in Missouri Ave. to E. A. JEFFERS, Alliance. Noted June 1.

Neb., Miller—City awarded contract for water system to ALAMO ENGINE AND SUPPLY CO., Omaha, at $10,152. Noted Apr. 27.

Neb., Pawnee City—Contract for water-works system awarded to HAMILTON BROS., Cleburne, Tex., at $44,345.

Mo., Kansas City—City awarded contract for 875 tons 6- and 8-in. c.-i. pipe to AMERICAN CAST IRON PIPE CO., at $30.96 per ton.

Tex., Galveston—City received bids for 3,400 ft. c.-i. water pipe on portion of Ave. H as follows: U. S. Cast Iron Pipe and Foundry Co., 122 South Michigan Ave., Chicago, Ill., $30.50 per ton; R. D. Wood & Co., Philadelphia, Penn., $32; American Cast Iron Pipe Co., $31.50 and $30.50.

Colo., Trinidad—(Official)—City awarded contract for pipe line, trenching and backfilling connecting pipe line with reservoir to ALLEN & MURPHY, 312 McPhee Bldg., Denver, at $49,286. Noted June 15.

Utah, Knysville—City awarded contract for storage reservoir to WHEELWRIGHT BROS., Ogden. Noted June 1.

Wash., Aberdeen—City will build water system by day labor. Estimated cost, $217,800. Noted June 22.

Calif., Calexico—(Official)—City awarded contract for improving and extending water system to H. R. BOYNTON CO., at $21,764. Noted May 25.

Calif., Sierra Madre—(Official)—City will lay new water mains by day labor. Franklin Biederman, Supt. Noted Jan. 20 and June 1.

Ont., Niagara-on-the-Lake—(Official)—Contract for filtration plant has not been awarded to INTERNATIONAL FILTER CO., Chicago, Ill., as stated in our issue of June 15.

SEWERS

Proposed Work

N. H., Manchester—City plans improving sewer system. S. J. Lord, City Engr.

Mass., Agawam—City plans sewer system. Receiving bids July 1. Durkee, White & Towne, 17 Hampden St., Springfield, Engr.

Mass., Holyoke—Board of Public Works plans sewers in Hillside Ave. and Yale St. F. J. McCarthy, City Engr.

R. I., Westerly—City plans sewer system. Estimated cost, $200,000.

Conn., Manchester—City plans sewers in north section. Estimated cost, $20,000.

N. Y., Catskill—City plans sewage-disposal plant. Estimated cost, $100,000. Wilson Edwards, Clk.

N. Y., New York—(Borough of Brooklyn)—(Official)—L. H. Pounds, Borough Pres., Room 2, Borough Hall, receiving bids July 5 for sewers in portions of Bay 29th St., 76th St., Beverly Rd. and sewer basins on Benson Ave.

N. Y., New York—(Borough of Brooklyn)—(Official)—L. H. Pounds, Borough Pres., receiving bids July 5 for sewers in portions of Pacific St. and Troy Ave. Noted Apr. 27.

N. Y., Ogdensburg—City preparing plans for sewer in Proctor Ave. Estimated cost, $5,000. D. Creighton, City Clk.

N. Y., Oneida—City preparing plans for storm sewers in various streets. J. M. Hutton, Engr.

N. Y., Syracuse—Common Council plans sewers in 70th ward. H. A. Allen, City Engr.

N. J., Avon—City plans sewers. J. H. Emlen, Engr.

N. J., Burlington—U. S. Cast Iron Pipe and Foundry Co. plans sewage-disposal plant. Day & Zimmerman, Engr.

N. J., Lakewood—City plans sewers. Carrol P. Bassett, Engr.

N. J., Rockaway—Sewerage Commissioners of Dover plans sewage-disposal plant near Dickersons Bridge. Estimated cost, $10,000.

N. J., Skillman—New Jersey State Epileptic Village receives bids for sewage-disposal plant. Estimated cost, $45,000. George S. Drew, Trenton, Arch. Noted May 18.

N. J., Somerville—Council plans extending sewer system along Doughty Ave.

N. J., Toms River—City plans sewer system and sewage-disposal plant. Remington & Vosburg, Engr.

N. J., Trenton—City Commission plans sewers in Lyndale, Park and Bismarck Ave. L. D. Hirsch, City Clk.

N. J., Westfield—City receives bids for relief sewer. A. W. Mars, Engr. Noted May 18.

Penn., Chester—Board of Commissioners of Lower Chichester Township plans sewer system and sewage-disposal plant. B. G. Ladomus, City Engr. Noted Apr. 20.

Penn., Lansdale—City instructed by State Commissioner of Health to build sewer system. Address City Clerk, Lansdale.

Penn., Sayre—City preparing plans for sewer system and sewage-disposal plant. R. R. Fernow, Weightman Bldg., Philadelphia, Engr.

Penn., Windber—City preparing plans for sewage-disposal plant and sewer system. C. P. Collins & Co., Johnstown, Engr.

W. Va., Star City—City voted $8,000 bonds for sewers and paving.

N. C., Kernersville—See item under "Water-Works."

Ga., Atlanta—City plans sewers in English Ave. C. E. Kauffman, City Engr.

Fla., Miami—See item under "Water-Works."

Miss., Batesville—City voted $5,500 bonds for sewer system. Noted June 22.

La., Baton Rouge—State Legislature appropriated $5,000 for sewer system at Jackson Insane Asylum.

Ohio, Niles—City plans sewers. Howard Turner, City Engr.

Ohio, Ravenna—Director of Public Service receiving bids Aug. 15 for sanitary sewers. Estimated cost, $9,000. W. H. Linton, Engr. Noted June 1.

Ohio, Wapakoneta—City votes Aug. 8 on $40,000 bonds for sewers.

Ill., Freeport—See item under "Streets and Roads."

Ill., Le Roy—Board of Local Improvements plan sanitary sewer system in Green St. A. T. Bailey, Mayor.

Ill., Matteson—City preparing plans for sewer system. A. Allen Fox, Chicago Heights, Engr.

Wis., Portage—City receiving bids July 5 for 2,600 ft. storm sewer. H. B. Tennant, City Engr.

Wis., West Bend—City Council receiving bids July 6 for storm sewers and laterals in various streets. Charles P. Heipp, City Clk.

Iowa, Lawler—City preparing plans for sewer system. D. G. Fisher, 213 Whitaker Bldg., Davenport, Engr.

Iowa, Oskaloosa—(Official)—City rejected bids received June 19 for sewage-disposal plant and 1 mi. of sanitary sewer to connect. City receiving new bids July 10. Black & Veatch, Kansas City, Mo., Consult. Engr. Noted June 15.

Iowa, Primghar—City preparing plans for sewer system. Bruce & Standeven, Bee Bldg., Omaha, Neb., Engr.

Iowa, Volga—City plans to vote on $20,000 bonds for sewer system and water-works. D. G. Fisher, 213 Whitaker Bldg., Davenport.

Minn., Battle Lake—City preparing plans for sewerage-disposal tank. Rose & Harris, Auditorium Bldg., Minneapolis, Engr.

Minn., Lake Crystal—City plans sewer system. Estimated cost, $30,000. A. Bates, City Clk.

Minn., Marble—City preparing plans for sewer system. J. F. Druar, 314 Commercial Bldg., St. Paul, Engr.

Minn., Pipestone—City plans storm sewers. Estimated cost, $11,000. L. P. Wolff, St. Paul, Consult. Engr.

Minn., Thief River Falls—City receiving bids July 11 for sewers. A. H. Fasel, City Clk. Noted June 15.

Kan., Nickerson—City plans sanitary sewers in various streets. E. F. Turbush, Clk.

Kan., Wetmore—City preparing plans for sewer system.

Kan., Wichita—City preparing plans for main sanitary sewer. Estimated cost, $200,000. Bert Wells, City Engr. Noted Feb. 10.

Neb., Fairbury—City receives bids for sewers in 4 districts. E. A. Wunder, City Clk.

Neb., Wymore—City votes on $14,000 bonds in July for sewer system. Noted May 11.

Wyo., Riverton—(Official)—City receiving bids July 6 for sewers. Estimated cost, $28,000. Address G. H. Lawrence, Lock Box 167, Riverton. Noted June 15.

Mont., Hardin—City votes July 10 on bonds for sewer system. A. L. Mitchell, Mayor.

Mont., Whitefish—City receiving bids July 3 for sewers in Sewer Districts Nos. 27 and 28. R. H. Wiedman, City Clk.

Tex., Houston—County receiving bids July 3 for sewer in Harrisburg Rd. H. L. Washburn, Houston, County Audr.

Tex., Lockhart—(Official)—City will install sewer system. Henry E. Elrod, Southwestern Life Bldg., Dallas, Consult. Engr.

Okla., Broken Bow—City plans sewer system. Address City Clerk.

Wash., Chehalis—City plans $33,193 bond issue for Murphy sewer.

Wash., Everett—City plans Delta District sewer system. Estimated cost, $27,000. H. Mumm, Jr., City Engr.

Calif., Hanford—City awards contract Aug. 1 for storm drain. Estimated cost, $35,000. Edward M. Lynch, City Engr.

Bids In and Contracts Awarded

Mass., Pittsfield—City builds sewers by day labor. Estimated cost, $10,000.

Conn., Hartford—City awarded contract for concrete conduit to inclose Gully Brook from Liberty to Garden St. to O'NEIL BROS., 324 Maple Ave., Hartford, at $66,027. Noted June 15.

N. Y., New York—(Borough of Bronx)—(Official)—City awarded contracts for sewers as follows: Home Ave., ANITA CONSTRUCTION CO; Crotona Parkway, JAMES A. BUCKLEY; West 238th St., MARRONE & DOVE. Noted May 11 and June 8.

N. Y., New York—(Borough of Brooklyn)—Low bids received June 21 for sewers in (a) Bay Parkway from Sea Beach Line to West 10th St., (b) 16th Ave. from 56th to 58th St., (c) Duryea Pl. from Flatbush Ave. to East 22nd St., as follows: Pasquali Tomasetti, 1133 60th St., (a) 94.95%; Murphy Bros., 25th and Cropsey St., (a) 98.50%, (b) 108%; G. Magliacane, (c) 107%; Frank L. Paino, (b) 124%, (c) 114%; E. Ghiraldi Contracting Co., (a) 99.97%, (b) 140%, (c) 115%. Noted June 15.

N. Y., New York—(Borough of Queens)—(Official)—City awarded contract for sewers in Jamaica, Maure and Woodhaven Ave. to JAMES H. JOHNSON, E. A. WEISS and H. J. MULLEN CONTRACTING CO., respectively. Noted June 8.

N. J., Camden—(Official)—Contract for sewers in 9th, Point, Fremont and other streets awarded to F. A. WARD, 524 Trenton Ave. Noted June 15.

N. J., Montclair—City awarded contract for storm sewers in Pine St. to JOSEPH CRESTON, Montclair, at $9,749. Noted June 8.

N. J., Paterson—Passaic Valley Sewerage Commission, Essex Bldg., Newark, received lowest bid from Culp Co., Inc., at $48,587, for Section 22 of Lawrence St. branch sewer. Noted June 8.

N. J., Point Pleasant—City awarded contract for extending sewer system to J. E. HARRIGAN, Point Pleasant, at $20,449. Noted June 8.

N. J., Trenton—City awarded contract for sewer in Dexter St. to A. COLANTINE, 42 Asbury St.

Ohio, Alliance—City awarded contract for improving sewage-disposal plant to HENDERSON CONSTRUCTION CO., Youngstown, at $36,440. Noted June 15.

Ohio, Cincinnati—(Official)—City awarded contract for improving sewer east and west of Reading Rd., Avondale Relief Sewers, Contract No. 4, to M. J. McCARTHY, 2910 Woodburn Ave., at $30,441. Noted June 8.

Ohio, Dayton—City awarded contract for storm-water sewers along Dry Hollow Creek to J. H. CAHILL, Louisville, Ky., at $97,199.

Ind., South Bend—City awarded contract for sewers in various streets to STAPLE & ACKERMAN, at $12,000.

Mich., Alma—City awarded contract for sewers to THOMAS SAMPSON, Mt. Pleasant.

Wis., Milwaukee—(Official)—City awarded contracts for Menominee Low Level Intercepting Sewer to WISCONSIN TUNNEL AND CONSTRUCTION CO., Milwaukee, at $268,172, Section No. 1, and to JAMES KENNEDY, Fargo, N. D., $248,439, Section No. 2. Noted May 18.

Minn., Blue Earth—City awarded contract for storm-sewer system to REPUBLIC CO., Albert Lea, at $23,860.

Minn., Duluth—(Official)—City installs sanitary sewers in 27th Ave., E., 41st Ave., W., Cascade and Piedmont Ave., and in 4th, Olney and other streets by day labor. Noted June 15.

Neb., Pawnee City—(Official)—City awarded contract for sanitary sewer system to HAMILTON BROS. CONSTRUCTION CO., Cleburne, Tex., at $44,345. Noted June 8.

Mont., Columbus—(Official)—City awarded contract for sewer system to SECURITY BRIDGE CO., Billings, at $7,300. Noted June 15.

Mont., Harlowton—(Official)—R. M. Bardsen & Co., Butte, at $39,670, submitted lowest bid for sewer and water-works system. S. K. Campbell, Town Clk. Noted June 8.

Mont., Manhattan—City awarded contract for sewer system to NORDSTROM & WILLIAMSON, Butte, at $14,686. Noted May 18.

Mo., St. Louis—(Official)—City awarded contract for Russell Place Joint District sewer and branches to COONEY-GARLAND CO., at $33,253. R. H. Witter, City Clk. Noted June 8.

Tex., Ennis—City awarded contract for sewage-disposal plant to ROACH-MANIGAN CO., Ft. Worth, at $15,000. Noted Mar. 9.

Tex., Houston—Texas Construction Co., at $52,350, submitted lowest bid for storm sewer in Page St. E. E. Sands, City Engr. Noted June 15.

Que., Chambley Canton—Town awarded contract for 11,000 ft. of sewers to S. W. HAMILTON, 11 Gosford St., Montreal. Estimated cost, $18,000.

Que., Donnacona—Municipal Council awarded contract for drainage system to P. C. COSTO, Donnacona, at $13,500. Noted Mar. 30.

Ont., Ingersoll—City awarded contract for storm sewers to McRAE & CAMPAIGNE, Niagara Falls, at $26,653.

GARBAGE

Proposed Work

Ind., Ft. Wayne—City plans garbage disposal plant.

Tex., Brownsville—City plans garbage incinerator. Address City Manager.

Ariz., Bisbee—(Official)—City will install garbage incinerator that is practical for city and that may not be too expensive to operate considering high price of fuel and labor at Bisbee.

Bids In and Contracts Awarded

N. Y., New York—(Borough of Manhattan)—Bids received June 19 for receiving and removing ashes by scows, Contract No. 1528. (a) Class 1, (b) Class 2, as follows: O'Brien Bros., Inc., 54 South St., (a) $1,355, (b) $1,216; Moran Towing and Transportation Co., (a) $1,540, (b) $1,382; Bowker Contracting Co., (a) $2,925, (b) $2,625.

STREETS AND ROADS

Proposed Work

Vt., Bellows Falls—State Highway Commission, Montpelier, will spend about $310,000 for road work.

Vt., Newport—City voted $30,000 bonds for paving.

Mass., Fairhaven—Massachusetts Highway Commission, Boston, will spend $15,000 for macadamizing Washington St.

Mass., Lowell—City plans to widen School St. Estimated cost, $7,000. Stephen Kearney, City Engr.

Mass., Pittsfield—City plans paving South St. Estimated cost, $96,000. A. B. Farnham, City Engr.

R. I., Lincoln—(Central Falls post office)—City appropriated $11,000 for roads and bridges.

Conn., Bristol—City receiving bids July 5 for paving Main St. C. W. Buell, City Engr.

Conn., Hartford—State Highway Commission receiving bids July 6 for following roads: Windsor Locks Township, 3,300 lin.ft. concrete or macadam; Clinton Township, 2,400 lin.ft. trap rock surfacing; East Hartford Township, about 7,300 lin.ft. macadam; Stratford Township, 6,800 lin.ft. macadam; Lebanon Township, 6,919 ft. macadam. Charles J. Bennett, State Highway Comr.

Conn., Putnam—City votes on $5,000 bonds for road improvements.

Conn., Torrington—City appropriated $20,000 for improving Main St. C. A. Patterson, City Engr.

Conn., Wallingford—(Official)—City receiving bids July 5 for 4,000 sq.yd. concrete paving. W. A. MacKenzie, City Engr. Noted June 1 and 15.

N. Y., New York—(Borough of Brooklyn)—(Official)—L. H. Pounds, Borough Pres., Borough Hall, receiving bids July 5 for improving and laying sidewalks on portions Clermont, Stillwell, 3d, 4th and 20th Ave. and Ave. Q, Bergen, Bolivar, East 14th, East 17th, 59th, Sackman, West 1st, West 27th and West 30th St. and 120,000 gal. refined asphalt in liquid form.

N. Y., Oswego—County plans to improve 26.9 mi. of roads. Estimated cost, $81,000. Address County Clerk, Oswego.

N. J., Belvidere—Warren County plans to improve Harmony-Brainards Rd., 3 mi. Estimated cost, $13,000. Address Board of Freeholders.

N. J., Bloomfield—Town receiving bids July 3 for improving Columbus, Edison and Alva St. with bitulithic. E. Baechlin, Engr.

N. J., Morristown—Morris County rejected bids for improving Mt. Pleasant Turnpike from Hahover to Whippany. New bids July 26. Estimated cost, $46,000. Noted June 22.

N. J., Plainfield—City plans to improve Front St. A. J. Gavett, City Engr.

N. J., Princeton—City Council receiving bids July 5 for paving Nassau St. with asphalt block. Van Buren Cook, City Clk. Noted Jan. 20.

N. J., Trenton—Mercer County rejected all bids for resurfacing Lawrenceville-Princeton Rd. with bituminous concrete and brick. New bids will be received. Estimated cost, $124,000. Theodore Tobish, Trenton, County Engr. Noted Apr. 20 and June 1.

N. J., Trenton—City sold $72,000 bonds for paving. J. R. Fell, Jr., City Engr. Noted May 18.

Penn., Bradford—(Official)—City receiving bids July 3 for 8,000 yd. vitrified brick pavement. B. A. Wise, City Engr.

Penn., Pittsburgh—City plans to pave East St. Estimated cost, $24,000. R. Swan, City Engr.

Penn., Wilkes-Barre—City Council passed ordinance to curb and gutter portion of Grove St. B. K. Finch, City Engr.

Penn., Windber—(Official)—City Council passed ordinance to improve portion of Graham Ave. W. J. Vickroy, City Engr.

Va., Covington—Alleghany County, Covington District, voted $100,000 bonds for road work. Noted Feb. 17.

Va., Salem—Roanoke County plans voting on $150,000 bonds for roads in Cave Spring District. Address County Clerk, Salem.

W. Va., Clarksburg—Harrison County, Clay District, voted $300,000 bonds for road work. Address County Clerk, Clarksburg. Noted May 18.

W. Va., Clarksburg—(Official)—Harrison County defeated $200,000 bonds for road work in Simpson District. Noted May 18 and June 1.

W. Va., Fayetteville—Fayette County, Sewell Mountain District, voted $175,000 bonds for road work. R. J. Stegall, Fayetteville, Clk. Noted May 4.

W. Va., Fayetteville—Fayette County, Kanawha District, voted $350,000 bonds for road work. R. J. Stegall, Fayetteville, Clk. Noted Apr. 27.

W. Va., Harrisville—Ritchie County Court sold $240,000 bonds for roads in Clay District. A. D. Williams, Library Bldg., Morgantown, Ch. Rd. Engr. Noted Apr. 20 and May 25.

W. Va., Star City—See item under "Sewers."

W. Va., Wheeling—County receiving bids July 5 for improving G. C. and P. Rd. G. W. Steenrod, Wheeling, County Rd. Engr.

W. Va., Wheeling—County receiving bids July 5 for paving portion of National Rd. with brick, also furnishing paving block. G. W. Steenrod, Wheeling, County Rd. Engr.

W. Va., Wheeling—County receiving bids July 5 for resurfacing with bituminous macadam under 5 contracts. G. W. Steenrod, Wheeling, County Rd. Engr.

N. C., Albemarle—City plans paving number of streets. J. D. Spinks, City Engr.

N. C., Scotland Neck—City plans bond issue for paving. Address Mayor.

N. C., Warrenton—Bids will be received by Commissioners of Warren County, Warrenton, until July 3, for purchase of $30,000 bonds for road work in River Township. P. M. Stallings, Chn. Noted May 18 and June 22.

Fla., Miami—Dade County voted $40,000 bonds for roads. A. Belcher, Miami, Chn. County Comrs. Noted Apr. 13 and May 18.

Ala., Dothan—Houston County receiving bids July 10 for 20 mi. road. W. R. Koonce, Dothan, County Engr.

Ala., Gadsden—Etowah County plans Piedmont Rd., 9 mi. Address County Clerk, Gadsden.

Miss., Durant—County receiving bids July 3 for 27 mi. macadam road. Snowden & Hauser, Columbus, Engr.

Miss., Okolona—Chickasaw County, Supervisors District No. 1, voted $33,000 bonds for road work. W. A. Wilkinson, Houston, Clk.

Miss., Okolona—Chickasaw County, Supervisors District No. 4, will issue $7,000 bonds for road work. W. A. Wilkinson, Houston, Clk.

Miss., Vicksburg—Warren County plans $400,000 bond issue for road work. Address County Clerk, Vicksburg.

Ky., Albany—(Official)—Clinton County sold $50,000 bonds for roads and bridges. J. G. Sloan, Clk. Noted June 8.

Ky., Bedford—See item under "Bridges."

Ky., Brooksville—Bracken County voted $200,000 bonds for road improvements. Address County Clerk, Brooksville. Noted Apr. 20.

Ky., Cadiz—Trigg County voted $150,000 bonds for road work. Address County Clerk, Cadiz. Noted Apr. 20 and 27.

Ky., Louisville—County receiving bids July 3 for street grading. Address County Clerk, Louisville.

Ky., Maysville—City receiving bids July 3 for paving portion of 2nd and Carmel St. J. W. Lee, Mayor.

Ky., Mt. Sterling—(Official)—City receiving bids July 5 for about 10,000 yd. brick asphalt, tarvia, or bitulithic pavement. Estimated cost, $23,000. H. M. Ringo, City Clk. Noted June 8.

Ohio, Akron—City Council passed ordinance to improve portion of Mallison Ave. J. A. Gehres, City Engr.

Ohio, Alliance—City Council passed resolution to pave South Freedom St. from South to Waugh St. W. Shidler, City Engr.

Ohio, Ashtabula—(Official)—City receiving bids July 10 for grading, curbing and paving with brick various streets. L. A. Amsden, City Engr. Noted June 1.

Ohio, Bellaire—City Council passed resolution to improve portion of Hamilton St. A. J. Norton, City Engr.

Ohio, Bowling Green—Wood County receiving bids July 7 for following macadam roads: Needles Rd., 1 mi., $12,000; Winnup Rd., 5 mi., $64,000; Gillespie Rd., 5 mi., $65,000; Fuller Rd., 5¾ mi., $66,000; Gagahan Rd., 6 mi., $68,000; Walerious Rd., 2 mi., $18,000; Ayers Rd., 5 mi., $27,000; Brooks Rd., 1 mi., $8,000; Chamberlain Rd., 1½ mi., $8,000. John Gallier, County Engr.

Ohio, Cincinnati—Hamilton County receiving bids July 7 for improving Reading Rd. in Sycamore Township. Albert Reinhardt, Clk. W. H. Boch, Cincinnati, Highway Engr.

Ohio, Cincinnati—City receiving bids July 3 for paving Glenmore and Louis Ave. C. F. Hornberger, Dir. Pub. Ser. Frank Krug, City Engr.

Ohio, Cleveland—City receiving bids July 5 for paving portion of Bulkley Blvd. Robert Hoffman, City Engr. Noted May 25.

Ohio, Cleveland—Frank G. Hohen, Dir. of Schools, receiving bids July 17 for grading, cement walks, etc., at various school playgrounds.

Ohio, Cleveland—City plans to pave portion of East 49th, Wakefield and West 16th St. and Harris Ave. Robert Hoffman, City Engr.

Ohio, Cleveland Heights—(Warrensville post office)—Village receiving bids July 17 for improving Yellowstone Rd. H. H. Canfield, Clk. F. A. Pease Engineering Co., 804 Marshall Bldg., Cleveland, Engr.

Ohio, Columbus—City receiving bids July 5 for improving 18 streets. H. Maetzel, City Engr.

Ohio, Delaware—City Council passed ordinance to improve portion of West Central Ave. George S. Irwin, City Engr. Noted Apr. 27.

Ohio, Eaton—City sold $18,500 bonds for paving.

Ohio, Findlay—City Council passed resolution to improve portion of Amelia Ave. U. K. Stringfellow, City Engr.

Ohio, Hillsboro—Highland County plans $50,000 bond issue for road work. C. F. Clark, Hillsboro, County Engr.

Ohio, Holloway—City receiving bids July 15 for purchase of $6,000 bonds for improving Main St. J. L. Wilson, City Clk.

Ohio, Lakewood—City receiving bids July 17 for purchase of $58,900 bonds for improving Morrison and Victoria St. B. M. Cook, Finance Dir. E. W. Fisher, City Engr.

Ohio, Lakewood—City Council passed resolution to pave Cannon and Athens St. E. W. Fisher, City Engr.

Ohio, Lisbon—Columbiana County sold $11,000 bonds for road work. H. C. Armstrong, County Engr.

Ohio, Madeira—(Official)—Village receiving bids July 3 for cement sidewalks on north side of Camargo Rd. Frank L. Rey, Village Clk.

Ohio, Marysville—Union County plans to improve Richwood and La Rue Pike Estimated cost, $60,000. Address County Clerk, Marysville.

Ohio, Norwalk—(Official)—Huron County sold $316,[illegible] bonds for road work. C. E. Bloomer, Norwalk, Audr. Noted June 8.

Ohio, Piqua—City Council passed ordinance to improve portion of East Ash St. A. Schroeder, City Engr. Noted Apr. 20.

Ohio, Reading—(Official)—City receiving bids July 10 for improving Main St. W. F. Klopmeyer, 630 Third St., Clk.

Ohio, Sandusky—City Council passed resolution to improve portion of Bell St. R. L. Wager, City Engr.

Ohio, Smithville—(Official)—Village receiving bids July 15 for paving Summit and Milton St. D. D. Hartzler, Clk. Noted Mar. 30.

Ohio, South Charleston—City voted $7,000 bonds for street improvements.

Ohio, Steubenville—City Council passed resolution to improve portion of Superior St. J. N. Leech, City Engr.

Ohio, Tiffin—City Council passed resolution to improve portion of St. Clair St. L. O. Runkle, City Engr.

Ohio, Utica—(Official)—Village receiving bids July 8 for improving 6 streets with brick, about 13,700 sq.yd. C. W. Irwin, Newark, Engr.

Ohio, West Jefferson—City receiving bids July 10 for paving Walnut St F. G. Brown, Clk. Noted Apr. 27.

Ohio, Youngstown—City Council passed resolution to improve portion of Mahoning Ave. F. M. Lillie, City Engr.

Ind., Brookville—Franklin County receiving bids July 3 for macadam road. C. G. Reifel, Brookville, Audr.

Ind., Columbia City—Whitley County receiving bids July 5 for brick and concrete road in Cleveland Township. T. A. McLaughlin, Columbia City, Audr.

Ind., Columbus—Bartholomew County receiving bids July 5 for concrete road in Columbus Township. W. H. Scott, Columbus, Audr.

Ind., Covington—Fountain County receiving bids July 5 for gravel road in Davis Township. H. W. Newlin, Covington, Audr.

Ind., Crawfordsville—Montgomery County receiving bids July 5 for gravel road in Brown Township. W. F. Batman, Crawfordsville, Audr.

Ind., Danville—Hendricks County receiving bids July 3 for road in Clay Township. C. M. Havens, Danville, County Audr.

Ind., Delphi—Carroll County receiving bids July 5 for road in Rock Creek Township. H. D. Good, Delphi, Audr.

Ind., English—Crawford County receiving bids July 3 for road in Patoka Township. J. B. Enlow, English, Audr.

Ind., Frankfort—Clinton County receiving bids July 11 for 1 gravel road in Johnson Township and 2 in Union Township. E. Spray, Frankfort, Audr.

Ind., Franklin—Johnson County receiving bids July 3 for gravel roads in Ninevah and Union Townships. John C. Gregg, Franklin, Audr.

Ind., Goshen—Elkhart County receiving bids July 5 for road in Elkhart Township. A. R. Bemenderfer, Goshen, Audr.

Ind., Greenfield—Hancock County receiving bids July 3 for gravel road in Jackson Township. H. J. Rhue, Greenfield, Audr.

Ind., Greensburgh—Decatur County receiving bids July 3 for roads in Fugit and Clinton Townships. J. C. Barbe, Greensburg, Audr.

Ind., Jasper—Du Bois County receiving bids July 3 for 3 roads in Bainbridge Township. J. H. Seng, Jasper, Audr.

Ind., Jeffersonville—Clark County receiving bids July 3 for road in Monroe Township. G. W. Stoner, Jeffersonville, Audr.

Ind., Kokomo—Howard County receiving bids July 5 for 2 gravel roads in Ervin and Union Townships. William L. Benson, Kokomo, Audr.

Ind., Kokomo—Howard County receiving bids July 5 for asphaltic concrete road in Center Township. William L. Benson, Kokomo, Audr.

Ind., Lawrenceburg—Dearborn County receiving bids July 3 for macadam road in Center Township. H. E. Lutherbeck, Lawrenceburg, Audr.

Ind., Lebanon—Boone County receiving bids July 5 for roads in Washington, Sugar Creek and Jefferson Townships. C. Goodwin, Lebanon, Audr.

Ind., Logansport—Cass County receiving bids July 5 for road in Washington Township. A. P. Flynn, Logansport, Audr.

Ind., Monticello—White County receiving bids July 5 for roads in Monon, Round Grove and Liberty Townships. A. G. Fisher, Monticello, Audr.

Ind., Mt. Vernon—Posey County receiving bids July 7 for 15,710 ft. gravel road in Marrs Township and 14,024 ft. in Harmony Township. Joseph R. Haines, Mt. Vernon, Audr.

Ind., New Albany—Floyd County receiving bids July 14 for road in New Albany Township. E. Dupaquier, New Albany, Audr.

Ind., New Castle—Henry County receiving bids July 3 for 2 roads in Stony Creek Township. H. C. Elliott, New Castle, Audr.

Ind., Noblesville—Hamilton County receiving bids July 5 for 4 roads in Adams, Washington and White River Townships. W. O. Horton, Noblesville, Audr.

Ind., Paoli—Orange County receiving bids July 3 for gravel or macadamized road on line between French Lick and Orangeville Townships. E. A. Palmer, Paoli, Audr.

Ind., Peru—Miami County receiving bids July 11 for gravel and concrete roads in Peru Township. F. K. McElheny, Peru, Audr.

Ind., Rockville—Parke County receiving bids July 5 for gravel road in Reserve Township. C. Davis, Rockville, Audr.

Ind., South Bend—St. Joseph County receiving bids July 17 for road in Union Township. Arthur F. Wolf, South Bend, Audr.

Ind., Tipton—Tipton County receiving bids July 3 for gravel roads in Cicero and Madison Townships. O. Vanness, Tipton, Audr.

Ind., Vincennes—Knox County receiving bids July 5 for gravel road in Johnson Township. J. Muentzner, Vincennes, County Audr.

Mich., Albion—Citizens asked County Board to call election in November to vote on $800,000 bonds for roads. Address County Clerk, Marshall.

Mich., Spring Lake—Village receiving bids July 5 for paving State St W. D. Spencer, Village Clk.

Ill., Cairo—City receiving bids July 3 for improving portion of 3rd, 4th and 11th St. George F. Dewey, City Engr. Noted June 22.

Ill., Chicago—Board of Local Improvements plans to widen 12th St. Estimated cost, $8,000,000. John Ericson, City Engr.

Ill., Park Ridge—Board of Local Improvements receiving bids July 5 for 9,000 sq.yd. asphaltic concrete on Ashland Blvd. A. W. Lorenz, 400 Pullman Bldg., Chicago, Pres.

Wis., Cuba—Henry Kleinhammer prepared plans for 1,250 lin.ft. reinforced-concrete paving and 2,000 ft. curbing.

Wis., Madison—City will award contract for 50,000 sq.yd. paving. E. E. Parker, City Engr.

Wis., Sturgeon Bay—(Official)—City postponed paving number of streets. Noted June 15.

Iowa, Atlantic—Cemetery Association receives bids for concrete paving on Cemetery Rd. J. H. Main, Council Bluffs, Engr.

Iowa, Keokuk—City plans paving portion Franklin St. with brick. J. F. Winters, City Engr.

Iowa, Rock Rapids—City plans curbing and guttering Green, Carroll, Adams and Union St.

Minn., Buffalo—Wright County receiving bids July 11, for grading State Rd. 15, Job 25, also State Rd. 16, Job 26. John A. Berg, Buffalo, Audr.

Minn., Northfield—City receiving bids July 6 for paving. C. E. Hoppin, City Recdr.

Minn., Pipestone—City will pave 33 blocks with concrete. Estimated cost, $60,000. L. P. Wolff, St. Paul, Consult. Engr.

Kan., Atchison—City Council passed resolution to curb and pave portion Dickson Terrace. F. S. Altman, City Engr.

Kan., Columbus—City Council passed resolution to pave several streets. C. M. Cooper, Engr.

Kan., Minneapolis—City plans paving 8 blocks. J. P. Richard, Engr.

Kan., Salina—City Council passed resolution to improve portion Santa Fe Ave. P. G. Wakenhut, City Engr.

Neb., Omaha—City plans repaving portion of 13th St. J. A. Bruce, City Engr.

S. D., Mitchell—City plans paving Duff St. S. H. Smith, City Engr.

S. D., Yankton—City plans to pave portion of Cedar St. J. W. Summers, Audr.

N. D., Portal—City voted $10,000 bonds for road work.

Mont., Billings—City receiving bids July 5 for concrete curb in Improvement District Nos. 142 and 143. E. M. Sneckenberger, City Engr.

Mont., Billings—(Official)—City plans paving Yellowstone and Clark Ave. and adjacent streets. E. M. Sneckenberger, City Engr.

Mont., Helena—City plans paving Main, Fuller and Park Ave. Estimated cost, $13,000. J. E. McLeod, City Engr.

Mont., Oakville—City plans to hard surface Main St. Estimated cost, $14,403.

Mo., Doniphan—Ripley County plans $200,000 bond issue for road work. H. B. Jones, Ironton, County Judge.

Mo., Eminence—Shannon County will vote on $100,000 bonds for roads and bridges. D. L. Williams, Eminence, County Judge.

Mo., Joplin—City plans to curb and gutter portion of Gray and Jackson Ave. and 18th St. J. J. McAffee, City Engr.

Mo., Joplin—City receives bids for Class F macadam paving on St. Louis Ave. and concrete paving in alley between 14th and 20th St. J. J. McAfee, City Engr.

Mo., St. Louis—Board of Public Service, Room 315, City Hall, receiving bids July 11, for improving portion of Sacramento Ave. with bitulithic, Thurman Blvd. with asphalt and Waterman Ave. with concrete. Estimated cost, $25,000. E. R. Kinsey, Pres.

Mo., St. Louis—Board of Public Service, Room 315, City Hall, receiving bids July 7 for improving portions of following streets with brick paving and granite curbing: Fair Ave., $5,800; Crescent Ave., $7,800; Bamberger Ave., $18,850; 21st St., $8,450; Semple Ave., $15,150; Edwards St., $25,450; Compton Ave., 14,550; Schiller Pl., $27,050. E. R. Kinsey, Pres.

Mo., Trenton—City Council passed resolution to pave, curb and gutter portion of Ash St. M. H. Mooney, City Engr.

Ark., Hot Springs—Street Improvement District No. 11 receiving bids June 24 for paving with wood block portion Valley and Spring St. and Reserve Ave. E. S. Blasdel, Chn.

Ark., Texarkana—City plans concrete sidewalks on Broad, Pine and Vine St.

Ark., Van Buren—City plans to organize Paving District No. 3 to include 33,000 yd.

Tex., Athens—Henderson County Road District No. 3 receiving bids July 2 for road work. A. B. Axtell, Athens, Engr.

Tex., Brenham—Washington County, Precinct No. 3, defeated $300,000 bonds for road work. Noted May 18 and 25.

Tex., Caldwell—(Official)—Commissioners of Burleson County will not receive bids for constructing sand clay roads as stated in Apr. 20 issue. C. H. Malejowsky, Engr.

Tex., Corsicana—Navarro County voted $100,000 bonds for road work in Dawson District. Address County Clerk, Corsicana.

Tex., Dallas—City plans paving portion of Annex Ave. and Main St. H. Moseley, City Engr.

Tex., Galveston—City plans to pave portion of Ave. O with wood blocks. A. T. Dickey, City Engr.

Tex., Mt. Vernon—(Official)—City voted $75,000 bonds for road work in Precinct 1. L. W. Davidson, City Secy. Noted Apr. 13 and May 25.

Tex., Sinton—San Patricio County votes July 8 on $10,000 bonds for roads in Sodville District. Address County Clerk, Sinton.

Tex., Sinton—San Patricio County votes July 8 on $50,000 bonds for roads in District No. 5. Address County Clerk, Sinton.

Tex., Taylor—City votes July 3 on $50,000 bonds for paving. W. E. Dozier, City Engr.

Tex., Winnsboro—(Official)—Wood County voted $50,000 bonds for road work in District No. 5 and $18,000 for District No. 4. Noted June 8.

Tex., Woodville—Tyler County voted $73,000 bonds for road work in Precinct No. 1. Address County Clerk, Woodville.

Okla., Blackwell—City plans paving North Main St. C. V. Butcher, City Clk.

Okla., Elk City—Beckham County will hold election to vote on $10,000 bonds for road improvements in Merritt Township. Address County Clerk, Sayre.

Okla., Holdenville—Hughes County votes July 18 on $400,000 bonds for macadam roads. C. M. Lawrence, Holdenville, County Engr.

Okla., Sadie—(Official)—City voted $11,000 bonds for roads in Sadie Township. Noted June 8.

Idaho, Paris—City voted bonds for road work.

Idaho, Pocatello—City receiving bids July 6 for curbing and guttering in Local Improvement District No. 12. J. H. Giles, City Engr.

Idaho, Twin Falls—Twin Falls County, Buhl Road District, defeated $300,000 bonds for roads. Address County Clerk, Twin Falls.

Utah, American Fork—City Council passed resolution for Sidewalks Paving District No. 2. Estimated cost, $17,727. S. L. Swenson, Mayor.

Wash., Chehalis—Lewis County votes in November on $500,000 bonds for road work. Address County Clerk, Chehalis. Noted May 11.

Wash., Colfax—Whitman County rejected all bids for Permanent Highway No. 12. New bids will be received. Address County Clerk, Colfax.

Wash., Ephrata—Grant County receiving bids July 6 for 6½ mi. permanent highway.

Wash., Seattle—King County receiving bids July 11 for paving Permanent Highway No. 2-D with brick or concrete. Estimated cost, $20,000.

Wash., Spokane—City plans to improve Wellesley Ave. Estimated cost, $5,500. M. Macartney, City Engr.

Wash., Walla Walla—(Official)—City receives bids for curbing and paving various streets. Walter Rehorn, City Engr. Noted June 8.

Calif., Bakersfield—County sold $500,000 bonds for road work. Address Clerk, Bakersfield.

Calif., Fowler—City plans to pave 8th St. Estimated cost, $16,000.

Calif., Hanford—City will award contract for about 1,200,000 sq.ft. asphaltic concrete paving about Aug. 1. E. Lynch, Glendale, Engr. Noted June 1.

Calif., Sacramento—State Highway Commission, 515 Forum Bldg., receiving bids July 10, for highway from Sausalito to Larkspur, 6 mi. W. R. Ellis, Secy.

Ont., St. Thomas—City will pave Burrows Ave. with macadam and Moore St. with reinforced-concrete. W. B. Doherty, City Clk.

Ont., Tilbury—Town Council plans 2 mi. of paving. Estimated cost, $40,000 W. A. Hutton, Town Clk.

Ont., Toronto—City plans concrete curbings on Indiana Grove and Watkinson Ave., asphalt pavements on Indian Grove, Keele St., Pacific and Watkinson Ave., estimated to cost $11,380; treated wood block pavement on Bancroft Ave., at $6,822. R. C. Harris, Comr. of Wks.

Man., Brandon—City plans to macadamize 6th St. Estimated cost, $16,000. T. H. Johnson, Minister of Pub. Wks.

Bids In and Contracts Awarded

Maine, Norway—(Official)—Small & Ingalls, Bar Harbor, submitted lowest bid for paving and drainage system.

Mass., Boston—(Dorchester)—City awarded contract for paving to JAMES DOHERTY, 32 Calumet St., Roxbury, at $7,473. Noted June 22.

Mass., North Brookfield—Massachusetts Highway Commission awarded contract for road to COLUMBIA CONSTRUCTION CO., Boston.

N. Y., Cohoes—City awarded contract for repaving Remsen St. to LANGAN CONSTRUCTION CORPORATION, at $24,263.

N. Y., Elmira—City awarded contract for paving Walnut St. to HOLLERAN BROS., Elmira, at $11,062; John and High St., WARREN BROS. CO., Boston, Mass., at $19,830 and $10,307 respectively.

N. Y., Monticello—(Official)—Village awarded contract for paving St. Johns St. to FALL KILL CONSTRUCTION CO., Poughkeepsie, at $5,402. Noted June 8.

N. Y., New York—(Borough of Bronx)—(Official)—City awarded contract for paving portion of St. Marys St. and Walton Ave. to ASPHALT CONSTRUCTION CO., Madison Ave. and 137th St., Manhattan, at $5,565 and $4,241 respectively; West 180th St. to EDWARD B. HANDY, at $16,338. Noted June 8 and 22.

N. Y., New York—(Borough of Bronx)—(Official)—City received low bid for improving portion of West 180th St. and Grand and Burnside Ave. from Barber Asphalt Paving Co., Woolworth Bldg., Manhattan, at $19,655.

N. Y., New York—(Borough of Brooklyn)—(Official)—City received low bids for paving various streets were as follows: Cranford Co., 52 9th St., Bay 31st St., $5,466, Powell St., $6,186, Clarkson Ave., $7,477, 18th Ave., $9,762, 70th St., $4,162; Sicilian Asphalt Paving Co., 41 Park Row, Manhattan, Whipple St., $4,867; Brooklyn Alcatraz Asphalt Co., 407 Hamilton Ave., 79th St., $49,090; M. F. Hickey Co., 83 9th St., 41st St., $6,019; J. J. B. La Marsh, 487 Pearl St., Manhattan, 3rd Ave., $36,086; Rosenthal Engineering and Contracting Co., 165 Hooper St., Metz St., $12,322. Noted June 15.

N. Y., New York—(Borough of Queens)—(Official)—Borough received low bids for improving various streets as follows: Cleveland-Trinidad Paving Co., 6th Ave., $32,629, 2d St., $30,235, 10th St., $35,095; Borough Asphalt Co., 1301 Metropolitan Ave., Brooklyn, Jerome Ave., $37,462; E. W. Fitzpatrick, Ditmars Ave., $10,885, 47th St., $8,085. Noted June 15.

N. Y., New York—(Borough of Richmond)—(Official)—City received lowest bid for granite block pavement on portion of North St. from John E. Donovan, Port Richmond, at $4,466.

N. Y., Norwich—City awarded contract for paving Rexford St. to FRANK BUSHLEY, at $7,688. Noted June 1.

N. Y., Rensselaer—City awarded contract for improving Creek St. to M. F. DOLLARD, Van Vorst St., Albany.

N. Y., Rochester—City awarded contracts for paving as follows: FRANK V. BROTSCH, Clay Ave., $22,235, Dove St., $4,729; F. L. HAGAMAN CO., Waverly Pl., $4,189; RIBSTEIN-HOLTER CO., Delmar St., $7,792.

N. Y., Rome—Bids were received by Board of Public Works from Warren Bros. Co., Boston, Mass., for paving various streets of city with bitulithic as follows: West Park St., $11,573, Parry St., $7,185, East Bloomfield St., $7,113, Roberts St., $10,263, West Bloomfield St., $5,417, West Thomas St., $10,197, East Thomas St., $9,260. J. Plunkett, City Engr.

N. Y., Webster—State awarded contract for paving Main St. with brick to WHITMORE, RAUBER & VICINUS, at $35,000. Noted Jan. 13.

N. J., Belvidere—Warren County awarded contract for improving road from Port Golden to Belvidere to SALMON BROS., Netcong, at $49,927.

N. J., Lambertville—(Official)—City will improve North Main St. with macadam by day labor. Noted June 15.

N. J., Millburn — (Official) — Town awarded contract for paving Highland and Hobart Ave. and Parkway and Brantwood Dr. to OSBORNE & MARSELLIS CO., Upper Montclair, at $18,165 and $5,064. Noted June 8.

N. J., Newark—(Official)—City will pave North Canal St. by day labor. M. R. Sherrard, City Engr. Noted June 15.

N. J., Newark—Board of Works awarded contracts for paving as follows: GLENFIELD CONSTRUCTION CO., Newark, Halstead St., $17,370, Beaumont Pl., $8,079; MAHER & McNICHOLS, Harrison, Cliff St., $12,975; STANDARD BITULITHIC CO., Newark, Dayton St., $13,360. Noted May 18 and June 15.

Penn., Harrisburg—(Official)—State Highway Department awarded contracts for road work as follows: 2.75 mi. reinforced concrete pavement, 16 ft. wide, on Section 4 of State Highway Route No. 131, Birmingham Township, Delaware County, Juniata Co., Philadelphia, $47,756; 4 mi. of 16 ft. reinforced concrete pavement on Section 9 of State Highway Route No. 131 in East Nottingham and West Nottingham Townships, Chester County, SUTTON & CORSON CO., Ocean City, N. J., $61,040; 1 mi. of vitrified block pavement 22 ft. wide in Rochester Township, Beaver County, J. G. McGUIRE CO., New Brighton, $28,744; 0.83 mi. bituminous pavement, amiesite, in Whitemarsh Township, Montgomery County, PAUL J. SNYDER & CO., Philadelphia, $15,502. J. W. Hunter, Harrisburg, First Deputy State Highway Comr. Noted June 8.

Penn., Harrisburg—City awarded contract for 500 tons cement to ATLANTIC REFINING CO., 3344 Passayunk Ave., Philadelphia, at $17.37 per ton

Penn., Pittsburgh—Alleghany County awarded contract for 16 roads to BOOTH & FLINN CO., LTD., at $334,999; 1 to THOMAS CRONIN CO., at $21,023; 29,000 tons ballast and screenings to CI YESDALE STONE CO., $15,068; J. M. MAGUIRE & CO., stone, $7,191; DUQUESNE SLAG PRODUCTS CO., slag, $7,707; hauling material to R. H. CUNNINGHAM & SONS CO., FRANK BRYAN, W. H. JOHNSTON and CENTRAL SUPPLY CO., at $18,769.

Penn., Pittsburgh — (Official) — City awarded contract for paving Jackman, Florence and Parkview Ave. to DALLAS & NARDULLI, Pittsburgh, at $16,000.

Penn., Pottstown—Montgomery County awarded contract for paving High St. to W. G. JUST, Gwynedd, at $4,416. Noted June 15.

Penn., Sharpsville—(Official)—City awarded contract for paving Mercer Ave. to W. McINTYRE & SONS, Sharon. Noted June 8.

Penn., Vandergrift—(Official)—City awarded contract for improving McKinley Ave. to DUSTER CONTRACTING CO., Franetum, at $14,130. Noted June 15.

Del., Wilmington—City awarded contract for 123,000 sq.yd. paving to UNION PAVING CO., Schenectady, N. Y., at $1.62 per sq.yd. Noted May 18 and June 22.

Md., Baltimore—City received lowest bid for paving number of streets from Baltimore Asphalt Block and Tile Co., at $1.62 per sq.yd. R. M. Cooksey, City Engr. Noted June 8.

Va., Leesburg—Loudoun County awarded contract to COLVIN & GIPSON, Culpeper, for road in Broad Run District.

Ga., Savannah—City Council awarded contract for 325,000 asphalt paving blocks to CHAPMAN-CLARK CO., Savannah, at $22,327. E. R. Conant, City Engr.

Fla., Bradentown—Manatee County awarded contract for road work to CONTINENTAL PUBLIC WORKS CO., 2 Rector St., New York, N. Y. Noted May 4.

Fla., Jacksonville—Duval County will rebuild highway to St. Augustine, about 10 mi., by convict labor.

Fla., Miami—(Official)—City awarded contracts for paving to BUSCAYNE CONSTRUCTION CO., at $8,797 and L. R. BLACKMON, at $8,051. Noted Apr. 20 and May 11.

Fla., Sanford—County awarded contract for road work to SOUTHERN CLAY MANUFACTURING CO., WILSON CONSTRUCTION CO., AUGUSTA VITRIFIED BRICK CO., HAND BROS. and C. F. HARRISON. Noted June 1.

Fla., Sebring—(Official)—City awarded contract for paving and curbing to WILLIAM P. McDONALD CONSTRUCTION CO., Mt. Vernon, N. Y., at $60,000. Noted Mar. 30 and May 25.

Miss., Biloxi—Harrison County awarded contract for road from Biloxi to Pass Christian to WARREN BROS. CO., Boston, Mass. Noted Nov. 25 and Feb. 3.

Miss., Clarksdale—City awarded contract to W. R. ELLIS, Clarksdale, for 95,000 sq.yd. paving.

Miss., Cleveland—(Official)—City awarded contract for gravel pavement to JONES PLUMBING CO., Okalona, at $4,424. Noted June 15.

Miss., Greenwood—MEMPHIS ASPHALT AND PAVING CO., Memphis, Tenn., awarded contract for about 12,000 sq.yd. asphaltic concrete paving including curbing, guttering and drainage. S. Cobham, City Engr.

Miss., Louisville—Winston County awarded contract to F. D. HARVEY & CO., Memphis, Tenn., for roads in Beat 1.

La., Alexandria—De Sota Parish awarded contract for gravel for 63 mi. of road to TIOGA GRAVEL CO., at $100,000.

Ky., La Grange—Oldham County awarded contract for road to A. STOEPLER. Estimated cost, $10,000. D. Ireland, Engr. Noted Mar. 23.

Ky., Louisville—Jefferson County awarded contract to LOUISVILLE ASPHALT CO., at $19,911, for paving section of Preston St.

Ky., Wickliffe—(Official)—Commissioners of Ballard County awarded contracts for constructing gravel roads as follows: 5 mi. to G. SCAMAHORN, Rockport, Ind., $11,684; 7 mi. to ARMSTRONG & GRUBBS, La Center, $17,821; 5 mi. to FRAZER & WESTERN KENTUCKY CONSTRUCTION CO., $12,563. Bids were rejected on 28 mi. and new bids will be received until July 3. C. W. Lovell, Engr. Noted Mar. 9 and June 8.

Ohio, Cedarville—Village received bids for paving Main St., (a) Athens brick, (b) Townsend brick, (c) Rocking brick, as follows: W. Paynes, (a) $8,111, (b) $8,191; Bluff Bros., (a) $8,568, (b) $8,416, (c) $8,568; Wilson Engineering and Contracting Co., (a) $8,568, (b) $8,408, (c) $8,448. Noted Apr. 27 and May 25.

Ohio, Cleveland—(East Cleveland)—Commissioners of Cuyahoga County, Cleveland, awarded contract for improving portion of Euclid Ave. with 2-in. asphalt to CLEVELAND TRINIDAD PAVING CO., 420 Lakeside Ave., Cleveland, at $91,755, and PACE BROS. CO., 608 Marshall Bldg., Cleveland, at $83,954. W. A. Stinchcomb, County Surv. Noted May 4 and 18.

Ohio, Cleveland—City awarded contract for paving Ardon St. to CLEVELAND-TRINIDAD PAVING CO., Lakeside Ave., at $8,320.

Ohio, Dayton—(Official)—City awarded contract for paving Livingston Ave. and Beckham St. to W. J. KEMAN & CO. Noted May 26 and June 8.

Ohio, Eaton—(Official)—City awarded contract for paving to STRODBECK BROS., Middletown, at about $81,000. Noted Apr. 13 and May 25.

Ohio, Findlay—Harry H. Hall & Son submitted only bid for improving portions of Laquineo, Greenlawn and Glendale Ave. U. K. Stringfellow, City Engr. Noted Mar. 16 and May 25.

Ohio, Hamilton—City awarded contract for repairing Hillside Ave. to TARVIA CONSTRUCTION CO., 17 East 6th St., Cincinnati, at $4,007.

Ohio, Jefferson—(Official)—County awarded contract for improving Wayne Rd. No. 1 to WARD & NIMS, East Orwell, at $36,523.

Ohio, Niles—(Official)—City awarded contract for paving 2nd St. to JAMES DeJUTE, Niles, at $8,251. Noted May 25 and June 1.

Ohio, Shreve—City awarded contract for paving to GRAVES, BARRETT & LEACH, Wooster, at $4,400.

Ohio, Upper Sandusky—(Official)—Village awarded contract for improving Hazel St. to MODERN CONSTRUCTION CO., Fremont, at $27,236. Noted June 1.

Ohio, Warren—City awarded contract for paving portion of Ohio and Summit St. to JAMES McGLASHEN, Seneca St. to SMITH ENGINEERING CO., South Pine St. to VICTOR OLSON CONTRACTING CO. Noted Apr. 27.

Ohio, Warren—City awarded contract for paving portion of Waverly St. to DENNIS & DAUGHERTY. Noted Apr. 6.

Ohio, Warren—City awarded contract for improving Prospect St. to DENNIS & DAUGHERTY. Noted Apr. 6.

Ind., Broad Ripple—(Official)—City awarded contract for cement curbing on 6th St. to REASON & CO., Pendleton, at 40c. per lin.ft. Noted Apr. 20 and June 15.

Ind., Danville—Hendricks County awarded contract for 9 mi. of road to CUNNINGHAM CONSTRUCTION CO., Martinsville.

Ind, Fowler—County awarded contract for Kretzmire Rd. in Union Township to T. CALAHAN, at $20,567; Gress Rd. in York Township to EVANS & VAN NATTA, at $4,890. Noted May 25.

Ind., Franklin—(Official)—Johnson County awarded contract for road work to JOHN MURPHY, Greenwood, and BARNETT & TAYLOR. Noted May 18.

Ind., Lafayette—(Official)—County awarded contract for road in Wayne Township to A. PETERSON, West Point, at $4,328. Noted May 18.

Ind., Lebanon—City awarded contract for cement sidewalks on Stoltz St. to P. SHAHAN & SON, Lebanon, at 13½c. per sq.yd.

Ind., Vincennes—City received bids for paving Hart St. with asphalt from Fox Construction Co., Terre Haute and Premier Construction Co., Indianapolis. H. T. Watts, City Engr.

Ind., Vincennes—City awarded contract for paving Vigo Ave. to PREMIER CONSTRUCTION CO., at $1.81 per yd.

Ind., Winamac—(Official)—Town Board received bids for 32,250 sq.yd. paving, including 19,000 ft. combined curb and gutter from Palmer, Moore & Co., Logansport, $48,919; A. G. Cohie & Co., Frankfort, $48,922; Nijdl & Greenwald, Whiting, $49,250. Noted June 8.

Mich., Gilford—County awarded contract for 2½ mi. road to S. W. BURTON, Kaw Kawlin, at $20,100.

Mich., Petoskey—(Official)—City awarded contract for paving to CARPENTER CONSTRUCTION CO., at $1.60 per sq.yd.

Ill., Byron—Ogle County awarded contract for Black Hawk Trail to GUND GRAHAM CO., Freeport, at $17,223.

Ill., Chicago—(Official)—Sanitary District of Chicago received bids May 25 for repairing Sheridan Rd. in Winnetka from W. A. Kenefick, Chicago, $5,557; E. J. Mahoney & Co., Inc., Chicago, $5,950; Marquette Construction Co., Chicago, $6,427.

Ill., Freeport—(Official)—City awarded contract for paving and sewers to GUND, GRAHAM CO., Freeport, at $49,871. Noted Apr. 20 and June 8.

Ill., Joliet—City awarded contract for improving Center St. and Plainfield Ave. to R. F. CONWAY CO.

Ill., Kankakee—City awarded contract for paving Chicago Ave. to F. P. CAUGHLIN CO., at $32,621. Noted May 4.

Ill., Riverdale—County awarded contract for paving portion of Halsted St. to P. SIMONDS, at $10,484.

Ill., Rockford—City awarded contract for paving 18th Ave. and 11th St. to A. E. RUTLEDGE. Noted Mar. 9.

Ill., Springfield—(Official)—State Highway Department awarded contracts for road work as follows: Pike County, Section B, macadam, CAMERON, JOYCE & CO., Keokuk, Iowa, $15,676; Livingston County, Section D, oiled earth, L. S. KUHN, Bloomington, $12,001; Clinton County, Sections B and C, VAN DUSEN & BAUMBERGER, Greenville, $8,925; McHenry County, Section H, gravel, JAMES B. WRIGHT, Harvard, $11,799; Cook County, Section K, concrete, PETER SIMONS, Quincy, $16,484. William W. Marr, State Highway Engr.

Ill., Winnetka—(Official)—City awarded contract for paving to EDWARD M. LAINO, Highland Park, at $9,596. Noted June 8.

Wis., Ft. Atkinson—City awarded contract for paving Main St. to MURPHY CONSTRUCTION CO., Manitowoc.

Wis., Janesville—City received lowest bid for paving Oakland Ave. with asphalt macadam from BROWN & CONNORS. Noted Apr. 20 and May 25.

Wis., La Pointe—City awarded contract to LAKE & OLSON, Minneapolis, Minn., for sidewalks and guttering.

Wis., Oshkosh—County State Road and Bridge Committee awarded contract for road to LARSEN CONSTRUCTION CO.

Wis., Racine—City awarded contract to BIRDSALL-GRIFFITH CONSTRUCTION CO. for curbing and guttering Kearney Ave. P. H. Connolly, City Engr.

Wis., Superior—City awarded contracts for cement sidewalks to E. JOHNSON, E. SWANSON and RUSSELL CONSTRUCTION CO. Estimated cost, $30,000.

Iowa, Eldora—Hardin County awarded contract for 4 mi. of road to E. RANKIN, Lawn Hill.

Iowa, Estherville—Emmet County awarded contract for Dolliver Rd. to A. WALLINGFORD.

Iowa, Mt. Pleasant—City awarded contract for paving to WILLIAM HORRABIN, Iowa City, at $69,965.

Minn., Rochester—WIDELL CO., Mankato, at $25,000, awarded contract for paving South Glencoe St. J. C. Utton, City Engr.

Minn., Rochester—City awarded contract for paving North Broadway to WIDDELL CO., Mankato, at $24,000. Noted June 1.

Minn., St. Paul—Bids were reecived for grading Waseca, Page and Louisa St. from Keough Bros., $13,600; Thornton Bros., $17,487; C. Johnson, $18,892. Oscar Claussen, City Engr.

Kan., Arkansas City—City awarded contract for paving to CHARLES L. BESLER CONSTRUCTION CO., Winfield. Noted June 15.

Kan., Lawrence—City awarded contracts for paving as follows: A. R. YOUNG & CO., Louisiana St., $2.17; GLIDDEN & HOBBS, 16th St., $1.06; J. E. EDWARDS, alley west of Louisiana St., $1.05. E. H. Dunmire, City Engr.

Kan., Manhattan—City awarded contract for paving portion of Leavenworth and 16th St. to WATTS & AMMERMAN. Noted June 15.

Kan., Ottawa—(Official)—City awarded contract for paving 6th and Ash St. to A. L. COOK, Ottawa; Sycamore and Hickory St. to N. E. STUCKER, Ottawa. Noted June 8.

N. D., Fargo—(Official)—City received only bid for paving various streets with bitulithic from James Kennedy, at $2.09. Noted June 15.

N. D., Minot—City awarded contract for paving to HANLON & OKES, Sioux City, Iowa. Noted Apr. 27 and May 25.

Mo., Ilmo—City awarded contract for paving Hickory, 2nd and Cherry St. to J. H. ROUSE, Cape Girardeau.

Mo., Joplin—City awarded contract to V. E. KOCH, at $6,157, for paving McConnell Ave. and at $4,885, for 6th St.

Mo., Kansas City—City awarded contracts for paving as follows: J. L. WATERS & CO., 2622 Bellefontaine Ave., 15th St.; WILLISTON CONSTRUCTION CO., Gary, Ind., Baltimore Ave.; A. JAICKS & CO., American Bank Bldg., Wyandotte St. Noted Apr. 27 and May 18.

Mo., St. Charles—St. Charles County awarded contract for road work to RALPH DIERKER, at $7,800. Noted May 4 and June 1.

Mo., St. Joseph—City awarded contract for paving portion of Mitchell Ave. to YOUNG BROS. CONSTRUCTION CO.

Mo., St. Louis—Board of Public Service received low bids June 13 for street improvements as follows: F. P. McCormick, Compton Ave., $7,827; Eyermann Construction Co., Broadway, $9,914. Cherokee St., $6,028; F. A. Steirs, West Park Ave., $9,597; Skrainka Construction Co., Gano Ave., $9,957; E. R. Kinsey, Pres. Noted May 25.

Tex., Athens—Henderson County awarded contract for road work to COBB & GREGORY, Houston, at $60,000. Noted May 4 and June 8.

Tex., Groveton—Trinity County awarded contract for road and bridge work to MIDLAND BRIDGE CO., Midland Bldg., Kansas City, Mo., at $75,000.

Tex, Houston—Harris County awarded contract for paving Chocolate Bayou Rd. to COUCH & HOLLINGER, Houston.

Tex., Houston—Harris County let contract FINLEY METHOD CO., $13,000, for surfacing portion Clark St. Rd.

Tex., Liberty—Liberty County awarded contract to BEXAR CONSTRUCTION CO., San Antonio, for road work. About $60,000 available.

Tex., San Saba—(Official)—County awarded contract for improving highways and city streets to SHELTON CONSTRUCTION CO., at $74,500. Noted June 15.

Okla., Kiefer—(Official)—City awarded contract for 20 mi. roads with culverts to J. W. JUCKSET, Waco, Tex., at $99,607. Noted May 18.

Idaho, Sandpoint—City received lowest bid for paving Pine St. from Spokane Bituminous Paving Co., at $13,308.

Utah, Salt Lake City—(Official)—City awarded contract for sidewalks on Highland Dr. to RYBERG BROS., Kerns Bldg., at $4,620. Noted June 8.

Utah, Salt Lake City—(Official)—City awarded contract for paving portions of 8th and 4th St. to PARROTT BROS., INC., 824 South 4th West St., at $91,712. Noted June 8.

Nev., Reno—JOHN W. McDONALD CO., San Francisco, Calif., at $17,000, awarded contract for about 100,000 sq.yd. asphalt resurfacing in Virginia and First St.

Ariz., Tucson—(Official)—Pima County awarded contract for highways to WARREN BROS CO., at $99,655. Noted June 8.

Wash., Cathlamet—Wahkeakum County awarded contract for Cathlamet-Skamokawa Rd. to SLOANE BROS., 1717 Belmont Ave., Seattle, at $15,700. Noted May 4.

Wash., Goldendale—Klicketat County awarded contract for Permanent Highway No. 5 to H. L. WILSON CO., Walla Walla, at $23,455.

Wash., North Yakima—City awarded contract for paving several streets to WASHINGTON PAVING CO., Tacoma, at $54,346.

Wash., Olympia—County awarded contract for surfacing portion of Inland Empire Highway to J. E. Cunningham, Augusta St., Spokane, at $7,344.

Wash., Tacoma—(Official)—County awarded contract for improving Permanent Highway No. 7 to WASHINGTON PAVING CO., Savage-Scofield Bldg., at $37,843. Noted June 8.

Wash., Vancouver—Clark County awarded contract for Permanent Highway No. 3-A to O. D. WOLF, Washougal, at $7,896. Noted June 1 and 22.

Ore, Dallas—City awarded contract for paving and curbing Main St. to HOBSON & HOPKINS CO., Independence.

Ore., South Bend—County awarded contract for Permanent Highway No. 5 to T. H. COCHRAN & SONS, Portland, at $20,900.

Calif., Eureka—City awarded contract for ½ mi. highway to H. PADGETT, Fields Landing, at $5,410.

Calif, Eureka—City awarded contract for paving 2 mi. of streets to RICHMONDITE CO. and JOHNSON-SHEA CO

Calif., Los Angeles—City awarded contract for improving Marathon St. from Vermont Ave. to Hoover St to H. V. GENTRY, at $7,338.

Calif., Los Angeles—City awarded contract for improving Sunset Dr. from Sanborn to Myra Ave. to H. V. GENTRY, at $5,451. Noted June 22.

Calif., Los Angeles—City received low bid for macadam pavement and cement curbs on Craig Ave. and concrete pavement on Texas St. from E. A. Baker, at $10,855.

Calif., Los Angeles—T. C. BREITENSTEIN, 405 Douglas St., Pasadena, at $9,274, awarded contract for improving Meridian St.

Calif., Los Angeles—GEORGE R. CURTIS, 552 South St. Louis St., at $7,151, awarded contract for improving San Marine St.

Calif., Richmond—City awarded contract for improving 23rd St. to S. C. ROGERS, at $46,207. Noted Mar. 23.

Calif., Riverside—City awarded contract for 2.86 mi. paving to C. L. HYDE CONSTRUCTION CO., San Diego, at $14,639.

Calif., Selma—Contract for paving concrete highway through Selma awarded to THOMPSON BROS., Fresno, at $16,539. Noted Feb. 10 and June 22.

Calif., Stockton—County awarded contract for improving portion of New Hope Landing Rd. to E. A. BURNS, 335 North San Joaquin St., at $6,817. Noted May 25.

Calif., Stockton—City awarded contract for paving Miner Ave. to PAUL & CALDWELL at $10,959. Noted June 8.

Que., Quebec—Civic Road Committee awarded contracts for repairing streets to QUEBEC PAVING CO., A. MICHAUD, Three Rivers, and GEORGE MADDEN. Estimated cost, $57,812. Noted June 15.

Ont., Markham—City awarded contract for sidewalks to JOHN HARE. Estimated cost, $5,000. Noted Feb. 3.

INDUSTRIAL WORKS

Proposed Work

Mass., Lowell—Persian Rug Co., 23 Park Row, New York, N. Y., plans factory at Lowell. R. R. Livingston, 2 Rector St., New York, Engr.

Mass., West Stockbridge—Grangers Lime and Marble Co. plans 2-story, 32x60-ft. plant.

N. Y., Buffalo—Plans being prepared for 5-story, 80x90-ft. reinforced-concrete addition to factory of F. F. Dalley Co., Ltd., 321 Military Rd.

N. Y., Buffalo—Plans being prepared for 3-story, 80x300-ft. reinforced-concrete factory at Erie R.R. and Elmwood Ave. for Kittinger Furniture Co., 15 Front Ave.

N. Y., Clifton—Louis Dejonge & Co. plans factory at Simonson Ave. and Center St. Estimated cost, $330,000.

N. Y., Lockport—Lockport Glass Co. plans to enlarge plant.

N. Y., Niagara Falls—Thornton Chard, Arch., 101 Park Ave., New York, receives bids for 2-story, 50x100-ft. factory at Union and Iroquois St. for Hydrol Co., 125 Front St., New York. Estimated cost, $30,000.

Penn., Philadelphia—S. S. E. Co., 2300 Chestnut St., preparing plans for 1-story, 200x1,000-ft. factory at Front St. and Erie Ave.

Penn., Pottsville—D. G. Yuengling & Son, 5th and Mahantongo St., preparing plans for 3-story, 20x30-ft. warehouse. William D. Hill, 26 South Center St., Arch.

Penn., Waynesboro—Ames E. Bowman plans flour mill.

Penn., Williamsport—Williamsport Wire Rope Co. plans addition to plant.

Del., Wilmington—W. H. Hartloe preparing plans for factory at 3d and French St. Estimated cost, $12,000. J. J. Kennedy, Ford Bldg., Arch.

Md., Baltimore—Atlantic Refining Co. plans oil distributing plant.

Md., Baltimore—H. B. Davis Co., 407 Keyser Bldg., prepared plans for additions to plant at Keyser and Bayard St. J. E. Moxley, Jr., 531 North Calhoun St., Arch.

Md., Baltimore—William F. Hempel preparing plans for 1-story, 126x209-ft. garage and store building at North Ave. and 10th St. Estimated cost, $30,000. Herbert G. Jery, Munsey Bldg., Baltimore, Arch.

Md., Baltimore—McGraw Tire Co., 10 West Oliver St., plans 4-story plant at 33 West Mount Royal Ave. T. Wells Pietsch, American Bldg., Arch.

Md., Baltimore—Schloss Bros. & Co., Baltimore and Paca St., plans factory.

Md., Baltimore—Gomprecht & Bennesch receives bids for 4-story warehouse at Mulberry and Jasper St. Estimated cost, $50,000. O. G. Simonson, Maryland Casualty Tower, Arch. Noted June 22.

Md., Curtis Bay—Standard Guano Co., 1500 Continental Bldg., Baltimore, plans addition to plant.

Md., St. Helena—Chemical Pigments Co. plans factory.

Va., Abingdon—Abingdon Creamery Co. plans factory. Estimated cost, $25,000. R. W. Buhrman, Pres.

Va., Glasgow—Charles H. Locher, New York, N. Y., plans factory at Glasgow. Estimated cost, $100,000.

Va., Norfolk—Ford Motor Co., Detroit, Mich., plans assembling plant at Norfolk.

Va., Norfolk—Harris, Woodson, Barbee Co., plans factory. Henry G. Barbee, Secy.

Va., Norfolk—Norfolk & Western Railroad Co. plans grain elevator. Estimated cost, $1,000,000.

Va., Norfolk—Security Storage and Safe Deposit Co. preparing plans for warehouse. Estimated cost, 75,000. C. A. Aspinwall, Washington, D. C., Pres.

Va., Richmond—De Soto Fitz-Gerald plans addition to warehouse at 5th and Carey St.

N. C., Leaksville—Thread Mills Co., Spray, plans mill at Leaksville.

N. C., New Bern—New Bern Iron Works and Supply Co. plans factory.

N. C., Rocky Mount—Rocky Mount Mills plans addition. Estimated cost, $100,000.

N. C., Salisbury—Yadkin Bleaching Co. plans plant. Estimated cost, $200,000.

S. C., Columbia—Orangeburg Packing Co. plans factory.

S. C., Laurens—Laurens Bonded Warehouse Co. plans building. N. B. Dial, Pres.

Fla., Tampa—Tampa Steam Ways Co. plans addition to shipbuilding plant.

Ala., Montgomery—J. C. Tuberville & Sons plans factory. Estimated cost, $100,000.

Ala., Ft. Payne—Pine States Lumber Co. plans factory.

Miss., Arbo—Lumber-Mineral Co. preparing plans for rebuilding plant.

Miss., Greenwood—Planters Oil Mill and Manufacturing Co. plans to rebuild plant.

La., Bogalusa—W. H. Sullivan, of Great Southern Lumber Co., plans paper mill. Estimated cost, $1,000,000.

La., New Orleans—Robert Saunders, 7935 Burthe St., plans dye factory.

Tenn., Erwin—E. J. Owen, Sistersville, W. Va., and associates, plan pottery plant at Erwin. Estimated cost, $75,000.

Tenn., Jellico—Davis Manufacturing Co. plans 3-story, 30x100-ft. addition to plant.

Ky., Henderson—Birk, Lancaster & Co. plans warehouse.

Ky., Louisville—Kentucky Institute for the Blind, Frankfort Ave. near Haldeman St., preparing plans for laundry. Estimated cost, $20,000. F. Erhart, 409 Norton Bldg., Arch.

Ohio, Akron—Northern Ohio Traction and Light Co. plans 1-story, 40x150-ft. and 6-story, 35x180-ft. electric packing station. Estimated cost, $90,000.

Ohio, Barberton—Paul & Henry plans 2-story dairy and ice cream plant. Estimated cost, $20,000. C. D. Cooley Co., Century Bldg., Pittsburgh, Penn., Arch.

Ohio, Cleveland—Lakewood Furniture and Storage Co., preparing plans for 4-story factory on Detroit Ave. Estimated cost, $100,000. Steffens & Steffens, 1027 Williamson Bldg., Arch.

Ohio, Cleveland—Steel Products Co., Parkwood Rd., plans addition to plant. Estimated cost, $12,000. Christian, Schwartzenberg & Gaede, 1900 Euclid Ave., Arch.

Ohio, Cleveland—Bangor Co., 940 Prospect St., plans 6-story building on Bolivar Rd. Estimated cost, $60,000.

Ohio, Cleveland—National Bronze and Aluminum Foundry Co., 2539 East 79th St., preparing plans for addition to plant. Estimated cost, $15,000.

Ohio, Columbus—Columbus Mill and Mine Supply Co. plans warehouse on Marion Rd.

Ohio, Columbus—Ford Motor Co., Detroit, Mich., plans plant at Columbus.

Ohio, Lorain—Launder & Hersheimer plans factory.

Ohio, Lima—Garford Motor Truck Co. plans enlargement of plant.

Ohio, South Akron—Supreme Rubber Co. plans factory.

Ohio, Wadsworth—Wadsworth Brick and Tile Co. plans addition to plant.

Ind., Anderson—Sefton Manufacturing Co. plans addition to cost, $18,000.

Ind., Anderson—Lavelle Foundry Co. preparing plans for addition to foundry on Chase St.

Ind., East Chicago—E. B. Lamman Co. plans 2-story, 50x100-ft. warehouse. E. B. Lamman, McCook and 151st St., Pres.

Ind., Evansville—Midland Mirror Co. plans factory.

Ind., Michigan City—Home Brewing Co. plans factory.

Mich., Albion—Albion Bolt Co. plans factory. Mark Merriman, Pres.

Mich., Benton Harbor—Superior Steel Casting Co. plans factory. S. E. Doster, Pres. and Mgr.

Mich., Detroit—Timkin Detroit Axle Co. preparing preliminary plans for 1-story, 200x400-ft. foundry. E. M. Lane Co., 707 Trust Concrete Bldg., Engr.

Mich., Flint—Grand Cushion Spring Co. plans factory at south end of Flint. L. A. Young, Detroit, Pres. Detroit Wire Spring Co., interested.

Mich., Flint—Ford Motor Co. plans factory. Estimated cost, $60,000.

Mich., Muskegon—Lakeside Foundry Co. plans foundry on Western Ave. Estimated cost, $13,000.

Mich., Owosso—Standard Machine Co. plans addition to plant.

Ill., Chicago—J. T. H. Paleison, 140 South Clark St. will build machine shop to cost $12,000. W. Shank, Arch.

Ill., Chicago—T. A. Cummings Foundry Co., 1354 Cortland St., plans 1-story addition to plant. E. M. Newman, Arch.

Ill., Chicago—Jewel Belting Co. prepared plans for 3-story factory at 2831 South La Salle St. Estimated cost, $50,000. William H. Pruyn, Jr., Arch.

Ill., Chicago—E. B. Miller & Co. preparing plans for 6-story warehouse and factory. George C. Nimmons, 122 South Michigan Ave., Arch.

Ill., Hillsboro—American Zinc Co. plans factory.

Ill., Joliet—Joliet Stove Works prepared plans for 1-story addition to plant. Charles W. Webster, 309 Cutting Bldg., Arch. Noted Apr. 20.

Ill., Peoria—Peoria Malting Co. plans improving plant. Estimated cost, $100,000.

Ill., Rockford—Comet Automobile Co. plans factory. Harry E. Sackett, Rockford, Pres.

Ill., Salem—Sexton Manufacturing Co., St. Louis, Mo., plans factory at Salem.

Ill., Taylorville—Peabody Coal Co., 332 South Michigan Ave., Chicago, plans factory at Taylorville. Estimated cost, $100,000.

Wis., Fond du Lac—Session Ice Cream Co. plans 3-story factory at West Johnson and Bannister St. Estimated cost, $20,000. D. D. Smith, Mgr.

Wis., Grand Rapids—R. W. MacMulkin, Chicago, Ill., plans factory at Grand Rapids.

Wis., Milwaukee—General Welding and Manufacturing Co. preparing plans for 1-story factory on Oregon St. C. J. Keller, Arch.

Wis., Milwaukee—John Obenberger Forge Co. plans forge and machine shop at 63d and Lapham St. Klug & Smith, Arch.

Wis., Superior—Duluth-Superior Milling Co. plans to build factory. Estimated cost, $25,000.

Wis., Superior—Continental Motor Truck Co. plans factory on Belknap St.

Iowa, Davenport—Kohrs Packing Co. receiving bids July 1 for 3-story, 80x80-ft. cold-storage building. Estimated cost, $40,000. Clausen & Kruse, 315 Central Bldg., Arch.

Iowa, Marshalltown—Fisher Governor Co. plans addition to plant.

Minn., Brandon—Plans being prepared for warehouse for Brandon Farmers Society of Equity.

Minn., Winona—L. C. Campbell Milling Co. preparing plans for reinforced-concrete storage building. Toltz Engineering Co., Pioneer Bldg., St. Paul, Engr.

Kan., Coffeyville—Sinclair Oil Co. plans factory at 5th and Main St.

Kan., Hutchinson—Four S. Razor Co. plans factory on Ave. A.

Kan., Hutchinson—Kansas Acetylene Gas Manufacturing Co. plans factory at 902 South Main St.

Kan., Lincoln—Farmers Union plan grain elevator.

Kan., Topeka—Plans prepared by D. J. Davis & Co., Arch. Manhattan Bldg., Chicago, Ill., for 5-story, 75x150-ft. addition to plant of Wolff Packing Co. on Quincy St. Estimated cost, $50,000.

Neb., Fremont—John Monnich plans to build a 2-story garage at Fremont.

Neb., Huntley—Farmers Equity Union plans elevator.

Neb., Omaha—Alamo Farm Light Co. plans factory.

N. D., Fairmont—Equity Co-operative Mill and Elevator Co. plans to build flour mill at Fairmont. Estimated cost, $100,000.

N. D., Jamestown—Windsor Farmers Co-operative Elevator Co., recently organized, plans to build elevator at Jamestown. Henry Little, interested.

N. D., Kathryn—Kathryn Farmers Mutual Elevator Co. receiving bids July 10 for 50,000-bu. elevator.

Mo., St. Louis—Prest-O-Lite Co. prepared plans for building at Beaumont and Locust St. J. M. Hirshstein, Arch.

Ark., Camden—Rockwell Manufacturing Co. plans addition to plant.

Ark., Yellville—J. E. and Ross Lee and J. F. Green, Springfield, Mo., plans foundry and machine shop at Yellville.

Tex., Aransas Pass—Alamo Iron Works, San Antonio, plans factory at Aransas Pass.

Tex., Celina—Celina Mill and Elevator Co. plans to rebuild factory. Estimated cost, $30,000. B. F. Smith, Vice-Pres. and Mgr.

Tex., Dallas—Alston Boyd, Memphis, Tenn., and W. S. Fountaine, San Antonio, plan cotton-seed oil mill. Estimated cost, $150,000.

Tex., Galveston—National Brewery Co. plans cold-storage and ice plant. Estimated cost, $50,000.

Tex., Houston—Houston Brick Works plan addition to plant.

Tex., Rockwall—Union Gin Co. plans cotton gin. Estimated cost, $15,000.

Okla., Tulsa—Sinclair Refining Co. plans 10-story factory.

Colo., Delta—Delta Sugar Co. plans factory.

Colo., Grand Junction—American Refrigerator Transit Co. plans plant to cost $150,000. H. B. Kooser, Gen. Mgr.

Wash., Spokane—General Machinery Co., 315 Stevens St., plans warehouse at Freya and Riverside St.

Calif., Hanford—Kings County Creamery plans creamery.

Calif., Los Angeles—Gregg & Twiss preparing plans for 50x117-ft. garage and machine shop on Main St. Western Architectural and Building Co., 372 Wilcox Bldg., Arch.

Calif., Orange Cove—Orange Cove Citrus Association plans packing house.

Calif., Stockton—Wagner Leather Co., 120 Oak St., plans 2-story factory. Estimated cost, $12,000. J. Losekann, San Joaquin Bldg., Arch.

Ont., Berlin—Carbo Corporation, Chicago, Ill., plans factory at Berlin.

Ont., Trenton—Canadian Sprayer Co. plans factory.

Bids In and Contracts Awarded

Vt., Windsor—National Acme Manufacturing Co. awarded contract for 1- and 2-story tool room and warehouse to FLYNT BUILDING AND CONSTRUCTION CO., Palmer, Mass.

Mass., Brockton—Retail Grocers Bread Co. awarded contract for bakery on East Manchester St. to McDONALD & KIVELL, 155 Milk St., Boston, at about $50,000.

Mass., Chicopee—Excelsior Needle Co. awarded contract for addition to plant to W. A. NEWTON & CO., Springfield.

Mass., Cambridge—Boston Woven Hose and Rubber Co. awarded contract for factory to STONE & WEBSTER ENGINEERING CORPORATION, 147 Milk St., Boston.

Conn., Bristol—Bristol Brass Co. awarded contract for 120x180-ft. casting shop to SAMUEL AUSTIN CO., Bridgeport. Estimated cost, $35,000. Noted May 18.

N. Y., Auburn—Contract for 1-story, 45x200-ft. factory for Auburn Button Co. awarded to LUKE WILLIAMS, Green St.

N. Y., Buffalo—Contract for plant at Buffalo for International Agricultural Corporation, 61 Broadway, New York, awarded to HUGGER BROS., Marine Bank Bldg.

N. Y., Buffalo—Willys Overland Co., Toledo, Ohio, awarded contract for 4-story service building and show room to FRANK T. LEY CO., Springfield, Mass.

N. Y., Cortland—Contract for foundry and machine shop for Cortland Forging and Machine Works awarded to GROTON BRIDGE CO., Groton. Estimated cost, $35,000.

N. Y., Little Falls—Little Falls Felt Shoe Co. awarded contract for 3-story factory and office building to HALLIMAN & SNYDER, West Main St. Estimated cost, $30,000.

N. Y., New York—(Borough of Brooklyn)—Pure Oil Co. awarded contract for three 1-story tanks, three 2-story warehouses, pump house, wagon shed and garage at Gowanus Canal and 1st St. to WILLIAM KENNEDY CONSTRUCTION CO., Brooklyn. Estimated cost, $36,000. Noted June 22.

N. Y., New York—(Borough of Manhattan) — (Official) — Chevrolet Motor Co. awarded contract for plant at 57th St. and 11th Ave. to W. E. WOOD CO., Ford Bldg., Detroit, Mich.

N. Y., Niagara Falls—Aluminum Co. of America awarded contract for 6-story, 67x93-ft. reinforced-concrete addition to plant at Buffalo Ave. and 19th St. to TURNER CONSTRUCTION CO., 311 Prudential Bldg., Buffalo. Estimated cost, $100,000.

N. Y., Niagara Falls—Contract for 4-story, 50x175-ft. factory at Buffalo Ave. and Adams St. for Niagara Electro Chemical Co. awarded to BUFFALO STRUCTURAL STEEL CO., Dart St., Buffalo. Noted Mar. 23.

N. Y., Watervliet—Ludlum Steel Co. awarded contract for 1-story factory to S. AUSTIN & SONS CO., Cleveland, Ohio. Noted Mar. 9.

N. J., Hoboken—Trayers & Co. awarded contract for masonry for 2-story warehouse at 15th and Adams St. to MARTIN FARRELL & SON, 1108 Garden St. Estimated cost, $25,000.

N. J., Newark—Samuel Hirsch, 191 Livingston St., awarded contract for 2-story, 25x70-ft. warehouse to B. STEINBERG, 148 Boyd St.

Penn., Harrisburg—Polk Institute awarded contract for laundry to C. F. HAMILTON, at $22,925.

Penn., Meadville—Bronze Metal Co. awarded contract for addition to plant to WALTER G. HARPER CO. Estimated cost, $17,000. Noted Apr. 13.

Penn., Philadelphia—Hess Machine Works, 2512 Callowhill St., awarded contract for 2-story, 52x130-ft. machine shop at 50th and Lancaster St. to SUTTON & STEPHENSON, 1317 Washington Ave., Philadelphia. Noted June 8.

Penn., Philadelphia—Warner & Co. awarded contract for 8-story factory on 7th St. to WILLIAM STEELE & SONS CO. Estimated cost, $300,000. Noted June 22.

Penn., Philadelphia—James Dolan awarded contract for 2-story warehouse at Callowhill and Darien St. to THOMAS REILLY, Philadelphia. Estimated cost, $10,000.

Penn., York—Standard Chain Co. awarded contract for additions to plant to P. J. HARDY CONSTRUCTION CO. Estimated cost, $60,000. Noted May 25.

Md., Baltimore—Southern Stevedore Co. awarded contract for service building at Clinton St. and Pennsylvania R.R. to CONSOLIDATED ENGINEERING CO.

Md., Baltimore—Drury Lazenby Co., Inc., awarded contract for 5-story warehouse to REYNOLDS & HUGHES.

Va., Quantico—International Steel and Shipbuilding Co. awarded contract for plant to KAUCHER, HODGES & CO., Memphis, Tenn. Noted May 11.

N. C., Durham—Durham Hosiery Mill Co. awarded contract for 2-story warehouse to N. UNDERWOOD, Durham. Estimated cost, $28,300. Noted Apr. 27.

Ga., Tifton—B. Y. Wallace awarded contract to V. C. PARKER & SON, Waycross, for warehouse. Estimated cost, $25,000.

Ohio, Columbus—Columbus Packing Co. awarded contract for 4-story, 33x144-ft. warehouse and pickling house to E. ELFORD, 520 Commercial Bldg.

Mich., Bay City—Chevrolet Motor Co. awarded contract for building to WEBBER CONSTRUCTION CO.

Mich., Detroit—Continental Motor Co. awarded contract for 1-story, 60x260-ft. warehouse and factory to NATIONAL CONSTRUCTION CO., 1026 Dime Bank Bldg. Estimated cost, $200,000. Noted June 15.

Mich., Detroit—Detroit Brass Works awarded contract for 2-story factory at 1322 Brooklyn Ave. to STOKES & WHITTINGHAM, Detroit.

Mich., Lansing—National Grocery Co., 123 North East St., awarded contract for 3-story, 80x126-ft. warehouse to BYERS BROS., Kalamazoo. Estimated cost, $50,000. Noted Dec. 9.

Ill., Centralia—Witwer Tate Grocer Co. awarded contract for 2-story, 50x150-ft. warehouse to E. T. SHORT. Estimated cost, $10,000.

Ill., Chicago—J. Hetzel, 1801 Larabee St., awarded contract for warehouse to JACOB RODATZ, 209 South La Salle St. Estimated cost, $40,000.

Ill., Chicago—G. Magis, 1750 Fulton St., awarded contract for 2-story warehouse at 1750 Fulton St. to A. NILSON. Estimated cost, $20,000.

Ill., Chicago—B. Heller awarded contract for factory at 3925 Calumet Ave. to N. J. SUMMERBELL, Chicago.

Wis., Appleton—Appleton Wire Works awarded contract for 1-story, 30x104-ft. warehouse to CHARLES GREINKE, 833 Morrison St.

Wis., Chippewa Falls—Chippewa Falls Mercantile Co. awarded contract for 3-story warehouse to W. H. KINGSLEY, Faribault, Minn. Estimated cost, $45,000.

Minn., Proctor—Duluth, Missabe & Western Ry. awarded contract for roundhouse to McLEOD & SMITH, 705 Sellwood Bldg. W. McGonagle, Duluth, Gen. Mgr.

Minn., St. Paul—Contract for 2-story storage building for Great Northern Ry. awarded to SHEPLEY & JOHNSON. Estimated cost, $21,000.

N. D., Glover—C. E. Knox awarded contract for 50,000-bu. elevator to LOUIS BUEGE.

Tex., Ft. Worth—(Official)—Chevrolet Motor Co. awarded contract for plant to W. E. WOOD CO., Ford Bldg., Detroit, Mich. Noted May 25.

Utah, Ogden—Ogden Packing and Provision Co. awarded contract for plant to JAMES STEWART & CO., Salt Lake City. Estimated cost, $300,000. Noted Apr. 20.

Calif., Los Angeles—Harbor Warehouse Co. awarded contract for warehouse to C. J. KUBACH CO., at $47,769.

Ont., Berlin—Canadian Regal Motor Co. awarded contract for factory to PETER CRAGNOLINE, 386 King St., Berlin. Estimated cost, $50,000.

Ont., Toronto—Henry Greisman, 68 Adelaide St., E., awarded contract for warehouse to L. E. DOWLING, 167 Yonge St. Estimated cost, $50,000.

FEDERAL GOVERNMENT WORK

Proposed Work

Mass., Boston—Jacks—Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., receives bids for furnishing and delivering at Navy Yard, Boston, four 4-ton hydraulic jacks, under Schedule 9811.

Mass., Newburyport—Post Office—James A. Wetmore, Act. Superv. Arch., Washington, D. C., receiving bids Aug. 1 for post office at Newburyport.

N. Y., New York—Lockers—Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., receives bids for furnishing and delivering at Navy Yard, New York, 200 metal lockers under Schedule 9814.

D. C., Washington—Mixer—Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., receiving bids June 27 for furnishing and delivering at Navy Yard, Washington, 1 concrete mixer.

La., New Orleans—Custom House—James A. Wetmore, Act. Superv. Arch., Washington, D. C., receiving bids Aug. 2 for remodeling customhouse at New Orleans.

Ohio, Toledo—Riprap—Lighthouse Inspector, Buffalo, N. Y., receiving bids June 26 for about 1,400 tons riprap stone around Toledo Harbor Light Station.

S. C., Charleston—Crane—Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., receives bids for furnishing and delivering at Navy Yard, Charleston, one 5-ton electric hoist jib crane, Schedule 9801.

Panama—Miscellaneous Supplies—Maj. E. I. Brown, Gen. Pur. Officer, Panama Canal, Washington, D. C., receiving bids July 7 for miscellaneous supplies.

Bids In and Contracts Awarded

Maine, Portland—Heating Apparatus, etc.—Low bids received June 20 for heating system, refrigerating apparatus, etc., in U. S. Marine Hospital, Portland, from George A. Kees Domestic Engineering Co., St. Paul, Minn., at $9,983 and Willey & Calhoun, Portland, at $14,000. Noted June 15.

Maine, Rumford—Post Office—Bids were received June 22 for U. S. post office at Rumford (a) limestone, (b) sandstone, as follows: T. F. Moreau, Lewiston, (a) $77,730; Newport Contracting and Engineering Co., Newport News, Va., (a) $58,870; William H. Fissell & Co., New York, N. Y., (a) $62,000, (b) $65,900. Noted May 25.

Conn., Putnam—Post Office—U. S. Government received bids for post office at Putnam, (a) limestone, terra cotta entablature, (b) sandstone, terra cotta entablature, (c) limestone, limestone entablature, (d) sandstone, sandstone entablature, as follows: West Chester Engineering Co., White Plains, N. Y., (a) $49,898, (b) $51,900, (c) $51,900, (d) $53,400; William H. Fissell & Co., New York, N. Y., (a) $53,000, (b) $54,627, (c) $52,400, (d) $57,000; O. Gerlach, Frostburg, Md., (a) $53,780, (b) $55,000, (c) $53,460, (d) $54,600; Wheaton Building and Lumber Co., Putnam, Conn., (a) $53,748, (b) $54,290, (c) $55,218, (d) $56,325. Noted May 18.

N. Y., Tompkinsville—Buoys—Lighthouse Inspector, Third District, Tompkinsville, receiving bids July 6 for 400 wooden spar buoys.

N. Y., Tompkinsville—Repairing Wharves—Lowest bids received June 1 for repairing fender and wharves at General Lighthouse Depot, Tompkinsville, were as follows: Riverside Contracting Co., 39 Cortland St., New York, $4,847; Frank J. Eisinger, 588 Atlantic Ave., Brooklyn, $4,941; J. & F. Kelly, 15th St. and Hamilton Ave., Brooklyn, $5,241. Noted May 18.

N. Y., Waterloo—Post Office—U. S. Government received bids for post office at Waterloo as follows: E. H. Titchener, Binghamton, $52,000; G. W. Stiles Construction Co., Chicago, Ill., $53,842; West Chester Engineering Co., White Plains, N. Y., $53,948. Noted Feb. 10 and June 1.

Md., Baltimore—Dredging—Bids received June 15 for dredging in Patapsco River from Coastwise Dredging Co., Norfolk, Va., 11.9c., Sanford & Brooks Co., 24 Commerce St., Baltimore, 15c., Maryland Dredging and Contracting Co., 1515 Fidelity Bldg., 8¾c. Noted May 18.

D. C., Washington—Building—Bids received June 12 by Commissioner of Indian Affairs for employees' quarters at Kiowa Agency, Okla., as follows: Bawman & Jesse, Lawton, Okla., $6,424; Cockrill & Wilson, Lawton, Okla., $6,595; Fred B. Hannan, Lawton, $6,940.

D. C., Washington—Dredging—Only bid received by Bureau of Yards and Docks for 10,000 cu.yd. dredging at Navy Yard was Dorsey & Miller Co., Corcoran Bldg., at 18c. per cu.yd. Noted June 1 and 8.

Va., Magotha—Coast Guard Station—Contract for coast guard station and accessories at Smith Island Coast Guard Station awarded to E. HART, Norfolk, at $9,445. Noted May 11 and June 8.

Va., Norfolk—Buildings—Lowest bids received June 24 for buildings at Navy Yard, Norfolk, were: Newport Contracting and Engineering Co., Newport News, $15,334; John H. Nolan Construction Co., Washington, D. C., $16,330; W. F. Brent, Norfolk, $16,825. Noted June 8.

N. C., Hatteras—Coast Guard Station—Contract for coast guard station and accessories at Hatteras Inlet, Ocracoke Island, awarded to A. BURRAS, Hatteras, $8,944. Noted May 18 and June 8.

La., Minden—Post Office—Lowest bids received June 22 for post office at Minden were: Algernon Blair, Montgomery, Ala., $45,570; G. A. Shaul, Seneca, Kan., $45,950; T. Lovell's Sons, Weatherford, Tex., $47,313. Noted May 25.

La., New Orleans—Wharf—Lighthouse Inspector received low bid for wharf at Sabine Pass Light Station from BLODGETT CONSTRUCTION CO., Galveston, Tex., at $10,400. Noted May 25.

Ohio, Alliance—Post Office—Lowest bids received June 23 for post office at Alliance, (a) limestone, (b) sandstone, were: R. Mellor, Alliance, Neb., (a) $91,000, (b) $94,500; Cleveland Fire Proof Construction Co., Cleveland, (a) $97,545, (b) $99,897; Ohio Building and Construction Co., Cincinnati, Ohio, (a) $98,268, (b) $102,400. Noted June 1.

Ind., Michigan City—Dredging—Bids were received June 10 for dredging 2,150 cu.yd. in Michigan City Harbor from Fitzsimons & Connell Dredge and Dock Co., Otis Bldg., Chicago, Ill., 23c. per cu.yd.; Byrne Bros. Dredging and Engineering Co., 208 South La Salle St., Chicago, Ill., 40c.; Great Lakes Dredge and Dock Co., Monroe Bldg., Chicago, Ill., 22c. Noted May 18.

Ind., Washington—Post Office—Lowest bids received June 23 for post office at Washington, (a) brick faced with limestone trimmings, (b) with sandstone trimmings, (c) stone faced with limestone trimmings, (d) with sandstone trimmings, were: H. G. Mitchell, Scottsburg, (a) $49,995, (c) $52,095; A. W. Lane, Chicago, Ill., (a) $50,978, (c) $53,349; G. W. Stiles Construction Co., Chicago, Ill., (a) $52,510, (c) $54,307; Dunlop & Co., Columbus, Ohio, (a) $53,160, (c) $53,685, (c) $54,686, (d) $57,287. Noted May 25.

Wis., Lac du Flambeau—Building—Contract for building at Indian School awarded to HUGO STANN, Medford, at $9,780.

Wis., Neenah—Post Office—U. S. Government awarded contract for post office at Neenah to C. W. GINDELE, 3333 La Salle St., Chicago, Ill., at $45,750.

Neb., Alliance—Lowest bids received June 23 for post office at Alliance, (a) limestone, (b) sandstone, were: George A. Shaul, Seneca, Kan., (a) $56,996; Charles Weitz Sons Co., Des Moines, Iowa, (a) $57,548, (b) $59,500; G. W. Stiles Construction Co., Chicago, Ill., (a) $61,828. Noted June 1.

S. D., Crow Creek—Building—Contract for hospital at Crow Creek Indian School awarded to J. H. STEVENS, Chamberlain, at $13,117. Noted June 1.

Wyo., Ft. Laramie—Earth Work—U. S. Government awarded contracts for earth work on about 5½ mi. main canal, Ft. Laramie Unit, as follows: Schedule 1, MACARTHUR BROS., New York, N. Y., $38,225; Schedule 2, WINSTON BROS. CO., Minneapolis, Minn., $29,180; Schedules 3 and 4, J. E. HILTON, Billings, Mont., $54,320. Noted May 4 and June 15.

Colo., Grand Junction—Wood Stave Pipe—U. S. Government awarded contract for wood stave pipe for Grand Valley Project to PACIFIC TANK AND PIPE CO., Los Angeles, Calif., at $21,157. Noted Apr. 20.

N. M., Ft. Stanton—Reservoir—Contract for lining reservoir at U. S. Sanitorium, Ft. Stanton, awarded to E. WARE, El Paso, at $11,600.

N. M., Jicarillo—Building—Bids were received for hospital at Jicarillo Indian School from W. D. Lovell, Minneapolis, Minn., $14,700; H. Smith, Des Moines, Iowa, $19,691; F. R. Lake, Durango, $15,052.

Utah, Payson—Reclamation—Bids were received for reclamation work near Payson, (a) Schedule 1, (b) Schedule 2, (c) Schhedule 3, from Reynolds-Ely Co., Springville, (a) $41,646, (b) $44,200, (c) $44,659; H. G. Gilkerson, Salt Lake City, (a) $48,214, (b) $55.626. Noted May 11.

Ore., Marshfield—Buildings and Masts—Bids were received for 5 buildings and 2 wireless masts at Naval Radio Station from F. K. Gettings, Marshfield, at $27,223 and W. W. Ladd, Marshfield, at $19,826.

Ariz., Douglas—Post Office—U. S. Government received bids for post office at Douglas as follows: G. Fee, San Francisco, Calif., $77,000; W. D. Lovell, Minneapolis, Minn., $87,000; G. W. Stiles Construction Co., Chicago, Ill., $91,224. Noted May 25.

CANALS, DITCHES AND IRRIGATION

Proposed Work

N. Y., New York—(Borough of Bronx)—Drainage—Board of Health, Center and Walker St., Manhattan, receiving bids July 5 for draining section of salt marsh lands in Borough of Bronx. Haven Emerson, Pres. of Bd.

N. C., Salisbury—Drainage—Board of Drainage Commissioners of Beaver Dam Creek Drainage District plans $6,000 bond issue for improvements.

S. C., Orangeburg—Drainage—Rum Neck Drainage District, Holly Hill Township, plans $4,000 bond issue for drainage.

Fla., Baldwin—Drainage—Baldwin District prepared preliminary plans for drainage work, 80,000 acres. Isham Randolph Co., Jacksonville, Engr.

La., Morgan City—Reclamation—Company being formed to reclaim 136,000 acres in Terrebone Parish. Estimated cost, $2,000,000. William J. Castell, New Orleans, interested.

Ky., Paducah—Reclamation—John E. Johnson, Engr., preparing plans for draining Mayfield Creek to reclaim 40,000 acres. Estimated cost, $200,000.

Ill., Colfax—Drainage—Lawndale and Cropsey Drainage District awards contract for drainage. A. M. Hester, Colfax, Atty.

Ill., Illinois City—Levee—Drury Drainage District votes $65,000 bonds for levee repairs necessitated by overflow of Mississippi River. Charles Speckler, Illinois City, Secy.

Iowa, Council Bluffs—Drainage—Mosquito Creek Drainage District completed surveys for drainage. Bids received July 15. J. D. Hannan, County Audr.

Iowa, Nevada—Drainage—Highway Drainage District No. 74 plans draining highways in northern Sherman Township and southern Lincoln Township. Estimated cost, $55,000.

Wyo., Crowley—Drainage—City plans drainage system to drain 10,000 acres. R. A. Hart, Salt Lake City, Utah, Engr.

Wyo., Germania—Drainage—City plans drainage system. R. A. Hart, Salt Lake City, Utah, Engr.

Mont., Helena—Irrigation—Bid Springs Ranch Co. plans pumping plant to irrigate 800 acres.

Ark., Pine Bluff—Reclamation—Drainage Improvement District No. 6, known as Swan Lake District, plans to reclaim 12,500 acres. Estimated cost, $25,000.

Wash., Otis Orchards—Irrigation—Otis Orchards Irrigation District plans improving district. Estimated cost, $125,000.

Bids In and Contracts Awarded

Mass., Dartmouth—Dredging—John R. Burke, 78 Devon St., Boston, submitted lowest bid for dredging.

Mass., Wareham—Dredging—Board of Harbor and Land Commissioners received low bids June 7 for dredging in Wareham River, 135,000 cu.yd. as follows: Charles M. Cole, 80 Belmont St., Fall River, 31c. per cu.yd.; J. S. Packard Dredging Co., Providence, R. I., 34c. per cu.yd.; Boston Dredging Co., 40 Central St., Boston.

Ga., Monroe—Drainage—Alcony River Drainage District awarded contract for draining Alcony River to KARR & MOORE. Noted Jan. 27.

Mich., Ypsilanti—Drainage—Drain Commissioner awarded contract for Lambie Drain in Superior Township to R. J. BIRD.

Minn., Morris—(Official)—Ditch—County awarded contract for County Ditch No. 24 to CARL CHRISTENSEN, Litchfield, Minn., at $5,160. Noted June 8.

MISCELLANEOUS

Proposed Work

Mass., Brookline—Bathhouse—City receives bids for bathhouse. Estimated cost, $15,000. F. J. Untersee, 585 Boylston St., Boston, Arch.

Mass., New Bedford—Wharf—Holmes Coal Co. plans wharf.

N. Y., New York—(Borough of Manhattan)—Frogs and Switches—Public Service Commission, 120 Broadway, receiving bids July 6 for special work, frogs and switches, for use on Seventh Avenue Rapid Transit R.R.

N. Y., New York—(Borough of Manhattan)—Subway—Public Service Commission, 120 Broadway, receiving bids July 13 for part of Route No. 61, part of Broadway-Fourth Avenue Rapid Transit R.R.

Penn., Beaver—Swimming Pool—Tamaqua Club organized committee to raise $10,000 for swimming pool at school playgrounds at 10th Ave. and 15th St.

Penn., Chester—Piers—Sun Shipbuilding Co., Philadelphia, plans bulkheads, piers and shipways. Estimated cost, $500,000.

Penn., Philadelphia—Recreation Building—Board of Recreation, City Hall, receiving bids July 7 for recreation building.

Penn., Shamokin—Filling—City plans filling creeks between Franklin and Rock St. and Pine and Mulberry St. Estimated cost, $30,000.

Va., Charlottesville—Grandstand—Albemarle Horse Show Association plans grandstand, racing barns, etc.

Fla., Monterey—Pier—Pacific Improvement Co. plans pier and bathing pavilion at Pebble Beach on Carmel Bay. Estimated cost, $150,000.

Fla., Sarasota—Pier—City Council receiving bids July 10 for reinforced-concrete recreation pier. Robert C. Bruce, Comr. Pub. Wks.

Ala., Mobile—Pier—Southern Ry. plans to rebuild Pier No. 4. Estimated cost, $40,000. W. H. Wells, Washington, D. C., Ch. Engr.

Ohio, Cleveland—Swimming Pool—Commissioner of Purchases and Supplies, Room 511, City Hall, receiving bids July 5 for swimming pool in Garfield Park. Robert Hoffman, City Engr.

Ohio, Lakewood—Fire Station—City receiving bids July 17 for $30,000 bonds for fire stations. E. W. Fisher, City Engr. Noted Apr. 20.

Ohio, Lorain—Park Improvements—City receiving bids July 11 for $55,000 bonds for park improvements. George N. Damon, City Audr. C. M. Osborne, City Engr.

Ohio, Niles—Improving Cemetery—City plans improving Union Cemetery. Ordinance passed. Estimated cost, $5,000.

Ill., Hillsdale—Dike—Highway Commissioners of Canoe Creek Township plan dike along Rock River. J. F. Butger, Hillsdale, Chn. of Bd.

Mo., St. Joseph—Subway—State Public Service Commission ordered railroads and street railways to build subway near Union Station. Estimated cost, $443,591.

Mo., St. Louis—Levee Improvement—Board of Estimate and Apportionment appropriated $100,000 to Board of Public Utilities for extending harbor lines on levee in Carondelet and reclaiming land for industrial sites.

Tex., Dallas—Wharf—City votes $15,000 bonds for municipal wharf at Lake Charles. J. B. Winslett, City Clk.

Tex., Ft. Worth—Levee—Tarrant County Levee District receiving bids July 3 for levee.

Tex., Wharton—Bulkhead—Anahuac Canal Co. plans bulkhead across Turtle Bay. Thomas E. Ellis, Mgr.

Wash., Seattle—Comfort Station—Board of Public Works plans comfort station at 4th Ave. and Madison St. Estimated cost, $23,000.

Calif., Coalinga—Bathhouse—City plans bathhouse.

Calif., Venice—Bulkhead—City plans bulkhead along shore from Vista to Salt Air St. Estimated cost, $100,000. Address City Clerk.

B. C., Vancouver—Dock—Canadian Pacific Ry. plans dock. Estimated cost, $1,500,000. J. C. Sullivan, Winnipeg, Can. Ch. Engr.

Bids In and Contracts Awarded

Mass., Lynn—Fire House—City awarded contract for 2-story fire house to C. S. CUNNINGHAM & SONS CO., 101 Tremont St., Boston. Estimated cost, $25,000.

Mass., Plymouth—Seawall—City awarded contract for seawall and spur jetties to C. M. LEACH, P. O. Box 2285, Boston.

Conn., Bridgeport—Seawall and Filling—City awarded contract for seawall and filling at Seaside Park to T. A. SCOTT, New London, at $141,832. Noted June 1.

Conn., Windsor—Elimination of Grade Crossing—Low bids received June 20 by State Highway Commissioner for elimination of grade crossing as follows: Barbara & D'Auria, 63 Bank St., Waterbury, $40,284; Long Bros., 80 State St., Hartford, $39,800; Hyde Park Construction Co., 164 Federal St., Boston, Mass., $39,178. Noted June 8.

N. Y., New York—(Borough of Manhattan)—Pier—Low bids received June 15 for repairing pier at foot of West 55th St., North River, and constructing freight shed on pier and bulkhead adjacent with appurtenances as follows: Snare & Triest, $337,751; Ernest A. Weiss, $341,365; Post & McCord, $342,886. Noted June 8.

Penn., Sharpsburg—Embanking Tracks—Pennsylvania R.R. awarded contract for embanking tracks at west end of yards on Conemaugh Division to JOHN F. CASEY CO.

Md., Baltimore—Tunnel—Pennsylvania, Baltimore & Washington R.R. awarded contract for widening tunnel from Charles St. to Fulton Ave. to McMULLIN & MELVIN, New York, N. Y. J. C. Auten, Wilmington, Del., Prin. Asst. Engr.

Ga., Rome—Grandstand—North Georgia Fair Association awarded contract for grandstand to C. C. McKENZIE, Rome.

Miss., Greenville—Levee Work—Mississippi Levee Commissioners awarded contracts for 512,000 cu.yd. levee work to B. LOMOND, levee in Issaquena County; ROACH & STANSELL, Memphis, Tenn.; S. R. HUGHES CONSTRUCTION CO., Greenville, spur dike at Carters Neck; BURT, BOND & McMURRAY, Beulah, 10 sub-levees. Estimated cost, $100,000. Noted June 8.

Ohio, Cincinnati—Cell Work—City awarded contract for cell work at jail to STEWART IRON WORKS, Covington, Ky., at $126,500.

Ohio, Girard—Straightening Channel—Carnegie Steel Co. awarded contract for straightening channel of Mahoning River to DUQUESNE CONSTRUCTION CO., Pittsburgh, Penn.

Ill., Chicago—Bathhouse—Chicago Beach Hotel awarded contract for masonry for 2-story bathhouse at 51st St. to SUMNER SOLLITT CO. Estimated cost, $20,000.

Wis., Superior—Dock—C. Reiss Coal Co. awarded contract for extending dock 400 ft., rebuilding dock, new steel chutes, additional railroad trackage, etc., to HEYL-PATTERSON CO. Estimated cost, $100,000. Noted Feb. 3.

Minn., Minneapolis—Coal Pocket—Philadelphia & Reading Coal and Iron Co., 185 Lumber Exchange Bldg., awarded contract for coal pocket at 185 Western Ave. to CAMPBELL CONSTRUCTION CO. Estimated cost, $7,000.

Tex., Beaumont—Wharf—City awarded contract for municipal wharf to McKENZIE CONSTRUCTION CO., San Antonio.

Calif., Sacramento—Weir—City Commission awarded contract for weir to TEICHERT & AMBROSE, Ochsner Bldg., at $336,640. Noted June 15.

BUILDINGS

Proposed Work

Other items relative to Building Construction will be found under the following headings: "Industrial Works," "Federal Government Work" and "Miscellaneous."

Maine, Thomaston—State preparing plans for state prison. Estimated cost, $50,000. E. F. Fassett, 95 Exchange St., Portland, Arch.

N. H., Laconia—City preparing plans for high school. Estimated cost, $75,000. Albert H. Dow, Harriman Bldg., 400 Main St., Arch.

Mass., Canton—Massachusetts Hospital School preparing plans for 2-story, administration building. S. W. Mead, 20 Pemberton Sq., Boston, Arch.

Mass., Medford—City preparing plans for 3-story city hall. Estimated cost, $200,000. E. S. Bailey, 33 Cornhill St., Boston, Arch. Noted Jan. 27.

Mass., Milton—City preparing plans for 3-story addition to school. Estimated cost, $175,000. Kilham & Hopkins, 9 Park St., Arch.

Mass., Peabody—MacDonald & Herbert plans office building. Estimated cost, $50,000. R. B. Whitten, 580 Mass Ave., Cambridge, Arch.

Conn., New Britain—City receiving bids July 10 for 2-story, 120x155-ft. grade school. Estimated cost, $125,000. Unkelbach & Perry, 162 Main St., Arch. Noted June 8.

Conn., Wethersfield—Hartford Y. W. C. A. preparing plans for 2-story, 80x130-ft. vacation school. Estimated cost, $40,000. E. T. Hapgood, 36 Pearl St., Hartford, Arch.

N. Y., Binghamton—Board of Education plans $116,000 bond issue for improving 3 schools.

N. Y., Ilion—St. Augustines Episcopal Congregation receiving bids about July 1 for parish house and church. Estimated cost, $60,000. H. M. Congdon & Son, 18 Broadway, New York, Arch. Noted May 25.

N. Y., Medina—City votes on $125,000 bonds for school.

N. Y., Poughkeepsie—First Reformed Congregation receiving bids about July 1 for parish house and church. Estimated cost, $100,000. Walter B. Chambers, 109 Broad St., New York, Arch.

N. J., Atlantic City—J. R. Ogden, Arch., South Carolina Ave., preparing preliminary plans for 5-story, 75x150-ft. hotel. Estimated cost, $60,000.

N. J., Elizabeth—Sokal Polski Gymnastic and Benefit Society, Inc., preparing plans for 3-story, 50x100-ft. club house. Estimated cost, $40,000. J. B. Beatty, 57 Broad St., Arch.

N. J., Onondaga Valley—Board of Education preparing plans for 2-story school. Estimated cost, $150,000. Russell & King, Snow Bldg., Syracuse, Arch.

N. J., Passaic—First Russian National Protective Association, 175 3rd St., preparing plans for 4-story, 44x100-ft. club house, store and office building. Estimated cost, $40,000. F. Pirrone, Midland Ave., Garfield, Arch.

Penn., Chester—Church of the Resurrection prepared plans for school. Ballinger & Perrott, 17th and Arch St., Philadelphia, Arch.

Penn., Ebensburg—City plans school. Estimated cost, $65,000. W. S. Powell, Title Trust Bldg., Johnstown, Arch.

Penn., Harrisburg—Charles E. and George L. Doehne receiving bids July 10 for 5-story hotel. Estimated cost, $125,000. C. H. Kain, Doehne Bldg., Arch. Noted June 15.

Penn., Haverford—Haverford College preparing plans for laboratory. Baily & Bassett, Arch. Noted Jan. 20.

Penn., Lancaster—Reformed Theological Seminary receiving bids July 5 for 3-story, 40x127-ft. dormitory and 3-story, 30x100-ft. refectory. Dillon, McLellan & Beadel, 2 West 28th St., New York, N. Y., Arch. Estimated cost, $100,000. Noted June 1.

Penn., Lansdale—M. E. Church receives bids for parsonage and church. Estimated cost, $50,000. George E. Savage, Witherspoon Bldg., Philadelphia, Arch.

Penn., Midland—Board of Education preparing plans for high school. Estimated cost, $100,000. F. J. Merrick, Empire Bldg., Pittsburgh, Arch.

Penn., New Brighton—Board of Education receiving bids July 13 for 2-story, 120x140-ft. high school. Estimated cost, $100,000. W. G. Eckles, Lawrence Savings and Trust Bldg., New Castle, Arch. Noted Jan. 13.

Penn., Quincy—City receives bids for high and grade school.

Penn., Reading—City votes in November on $500,000 bonds for city hall.

Penn., South Mountain—State Asylum for Chronic Insane receiving bids July 3 for 2 ward buildings. Estimated cost, $130,000. A. A. Richter, 31 North 6th St., Reading, Arch. Noted Mar. 9.

Md., Baltimore—Hahnemann General Hospital preparing plans for building. Estimated cost, $200,000. Walter M. Gieske, 65 Gunther Bldg., Arch.

W. Va., Parkersburg—Baltimore & Ohio R.R. prepared plans for freight depot at 4th and Avery St. Estimated cost, $300,00. F. L. Stewart, Baltimore, Md., Engr.

Va., Richmond—Arcadia Amusement Corporation plans theater on Broad St. Estimated cost, $250,000. J. T. Anderson, interested.

Ala., Andalusia—Covington County Commissioners plan courthouse. Estimated cost, $100,000.

La., Baton Rouge—City receiving bids July 10 for 3 school buildings. B. J. Goodman, 833 North Blvd., Arch. Noted Apr. 13.

La., Many—Sabine Parish plans courthouse. Estimated cost. $85,000. Noted June 22.

La., New Orleans—Jerusalem Temple, Nobles of Mystic Shrine, prepared plans for building. Estimated cost, $150,000. W. Weil and S. Stone, New Orleans, Arch.

Tenn., Morristown—City plans 3-story city hall and auditorium.

Tenn., Nashville—Standard Property Co. prepared plans for office building. Estimated cost, $75,000. Marr & Holman, Stahlman Bldg., Arch.

Ohio, Bucyrus—Plans being prepared by D. S. Schureman & Son, Arch., Delaware, for high school for Board of Education.

Ohio, Columbus—C. Taylor, Park and Russell St., receiving bids July 10 for 2-story theater. Estimated cost, $65,000. Wilbur T. Mills, McCune Bldg., Arch.

Ohio, Delaware—Ohio Wesleyan University preparing plans for group of buildings. Henry Hornbostel, 63 William St., New York, N. Y., Arch.

Ohio, Gallipolis—Board of Education preparing plans for 2-story high school. Estimated cost, $80,000. Frank L. Packard, 1212 Hayden Bldg., Columbus, Arch. Noted June 8.

Ohio, Grand Rapids—Board of Education receiving bids July 7 for high and grade school. Estimated cost, $45,000. Howard & Merriam, 8 East Broad St., Columbus, Arch. Noted June 8.

Ohio, Kenmore—Board of Education preparing plans for 2-story high school. Estimated cost, $75,000. M. P. Lauer, 324 Hamilton Bldg., Cleveland, Arch.

Ohio, Lakewood—Board of Education preparing plans for high school. Estimated cost, $300,000. S. W. Hopkinson, 900 Rose Bldg., Cleveland, Arch. Noted June 8.

Ohio, Lancaster—John V. Monahan, care of Mithoff Hotel, plans 3-story, 90x192-ft. bank, hotel and store building. Estimated cost, $185,000.

Ohio, Leroy—School District receiving bids July 8 for auditorium. Briggs & Nelson, 669 Rose Bldg., Cleveland, Arch.

Ohio, Lockbourne—Board of Education receiving bids July 14 for school. Frank L. Packard, Columbus, Arch.

Ohio, Perrysburg—(Official)—Board of Education receiving bids July 14 for school. Estimated cost, $41,000. C. H. Van Norman, Clk. Noted June 1.

Ohio, Sandusky—Trinity Methodist Congregation plans church. Estimated cost, $50,000.

Ohio, Toledo—Board of Education receiving bids July 19 for Sherman School at Sherman, Walnut and Peck St. E. M. Gee, Arch.

Ohio, Van Buren—Board of Education receiving bids July 14 for school. McLaughlin & Hulsken, Lima, Arch. Noted Mar. 30.

Ohio, Warren—First Presbyterian Congregation prepareu plans for 2-story, 60x100-ft. church. Estimated cost, $50,000. Crow, Lewis & Wickenhoefer, 200 5th Ave., New York, N. Y., Arch.

Ohio, Warrensville—Bee Hive School District preparing plans for 2-story high and grade school. Estimated cost, $50,000. A. W. Rust Co., 8451 Broadway, Cleveland, Arch.

Ohio, Youngstown—City plans Carnegie Library. Estimated cost, $50,000.

Ind., Anderson—Y. M. C. A. receiving bids about July 12 for building. C. D McLane, Rock Island, Ill., Arch. Noted June 1.

Ind., Lafayette—Lafayette Life Insurance Co. preparing plans for 8-story office building. Estimated cost, $175,000. J. F. Alexander, Ball Blk., Arch.

Ind., Tefft—City receiving bids July 5 for high school for Kankakee Township. R. E. Davis, Trustee Kankakee Township.

Mich., Highland Park—Michigan State Fair Association preparing plans for 300x400-ft. coliseum. Estimated cost, $125,000. A. E. Harley, 1205 Kresge Bldg., Detroit, Arch.

Mich., Iron Mountain—A. E. Braune preparing plans for 2-story theater. Charlton & Kuenzle, 432 Camp Bldg., Milwaukee, Wis., Arch.

Mich., Jackson—Jackson City Club Building Co. preparing plans for 3-story club house, lodge and store building. Estimated cost, $60,000. Claire, Allen & Son, Dwight Bldg., Arch.

Mich., Lansing—G. F. Bach, 115 Allegan St., preparing plans for 5- or 6-story, 40x105-ft. store and office building. Estimated cost, $50,000. E. B. Phillips, Capitol Bank Bldg., Arch.

Ill., New Berlin—Board of Education receiving bids July 5 for high school. J. N. Coleman, 7100 South Chicago Ave., Chicago, Arch.

Ill., Streator—Park Presbyterian Congregation preparing plans for 3-story, 90x120-ft. church. Estimated cost, $75,000 William C. Jones, 38 North La Salle St., Chicago, Arch.

Wis., Berlin—Board of Education plans high school. Estimated cost, $100,000. Parkinson & Dockendorff, La Crosse, Arch.

Wis., Plymouth—Hospital Association preparing plans for hospital. Byron S. Scheiderer, Milwaukee, Arch. Noted Dec. 2.

Iowa, Carroll—City voted $100,000 bonds for school. William R. Smith, Secy. Bd. of Education. Noted May 25.

Iowa, Davenport—St. Lukes Hospital preparing plans for building. Estimated cost, $150,000. Temple & Burrows, 63 McManus Bldg., Arch. Noted Apr. 27.

Iowa, Davis City—E. J. Shelton and H. C. Young interested in hospital and nurses home.

Iowa, Iowa City—City plans to vote July 12 on $250,000 bonds for schools.

Iowa, Jesup—Consolidated School District preparing plans for 2-story school. Estimated cost, $75,000. H. E. Netcott, Independence, Arch. Noted June 15.

Iowa, Osceola—Board of Education preparing plans for high school. Estimated cost, $85,000. Miller, Fullenweiter & Downing, 6 North Michigan St., Chicago, Ill., Arch. Noted Mar. 23.

Iowa, Ottumwa—City votes July 18 on $125,000 bonds for high school. J. A. Wagner, Secy. Bd. of Education. Noted Mar. 23.

Iowa, Pocahontas—Pocahontas County defeated $150,000 bond issue for courthouse. Noted May 4.

Iowa, Valley Junction—Board of Education receiving bids July 9 for 2-story high and grade school. Estimated cost, $45,000. Proudfoot, Bird & Rawson, 810 Hubbell Bldg., Des Moines, Arch. Noted May 25.

Minn., Minneapolis—Zuhrah Temple of Shriners plan temple on Lyndale Ave. Estimated cost, $150,000. E. W. Decker, in charge.

Minn., Red Wing—Board of Education receiving bids July 12 for high and grade school. Bell & Bentley, Inc., 518 Security Bldg., Minneapolis, Arch. Noted June 8.

Kan., Arkansas City—City voted $60,000 bonds for municipal building.

Kan., Atchison—Brown County plans courthouse. Estimated cost, $110,000.

Kan., Kiowa—Board of Education prepared plans for 2 story school. Estimated cost, $40,000. S. S. Voigt, Barnes Bldg., Wichita, Arch. Noted May 25.

Kan., Osborne—Order of Masons receives bids for 3-story, 50x100-ft. lodge building. F. C. Squires, 628 Kansas Ave., Topeka, Arch. Noted June 1.

Kan., Ottawa—City preparing plans for high and grade school. Estimated cost, $200,000. G. P. Washburn & Son, Arch. Noted May 25.

Kan., Parsons—City plans election to vote on $60,000 bonds for city hall. C. W. Frys, Clk.

Kan., Pittsburg—Board of Education plans addition to high school. Estimated cost, $40,000.

Kan., Seneca—City votes July 13 on bonds for city hall.

Neb., Omaha—City prepared plans for Clifton Hill Grade School at 45th and Maple St. Estimated cost, $110,000. F. W. & E. B. Clarke, Brandeis Theater Bldg., Arch.

Neb., Tekamah—Burt County preparing plans for 3-story courthouse. Estimated cost, $75,000. Rose & Peterson, Barker Bldg., Kansas City, Kan., Arch.

Mont., Billings—B. Leavens, 921 North 31st St., plans 150x250-ft. theater.

Mo., Kansas City—Board of Education receiving bids July 6 for 3-story reinforced-concrete library. Estimated cost, $200,000. Smith, Rea & Lovitt, Arch.

Mo., Sedalia—Hotel Sedalia Building Co. plans 5-story, 82x116-ft. hotel. Estimated cost, $150,000.

Mo., Webb City—City plans to enlarge city hall and jail.

Tex., Addison—Addison Independent School District voted $75,000 bonds for school.

Tex., Austin—University of Texas receives bids for building. Estimated cost, $200,000. Cass Gilbert, 11 East 24th St., New York, N. Y., Arch. Noted June 22.

Tex., Beaumont—City votes July 18 on $300,000 bonds for 4 ward schools and 1 high school. J. G. Sutton, City Clk. Noted June 22.

Tex., Brownwood—Methodist Church plans building. Estimated cost, $40,000.

Tex., San Antonio—A. A. Luther and associates preparing plans for club house. Estimated cost, $150,000. H. L. Page, Arch.

Tex., Sherman—City votes on $100,000 bonds in July for school.

Okla., Ardmore—Plans being prepared for hotel. Estimated cost, $90,000. J. R. Sharpe, Dallas, Tex., interested. Noted Mar. 16.

Okla., Holdenville—Hughes County votes in July on $100,000 bonds for courthouse and jail. A. J. Johnson, County Clk. Noted Dec. 9.

Okla., Tulsa—Sinclair Oil Co. plans 10-story office building at 5th and Main St.

Colo., Las Animas—School District No. 1 votes July 10 on $50,000 bonds for school.

N. M., Tucumgari—City plans school. Estimated cost, $50,000.

Idaho, Nampa—School Board receives bids for high school. Estimated cost, $58,000. Noted Mar. 16.

Utah, Salt Lake City—Salt Lake Aerie No. 67, Fraternal Order of Eagles, plan clubhouse. Estimated cost, $50,000. H. S. McCann, Secy.

Wash., Spokane—Deaconess Hospital Association plans hospital. Estimated cost, $125,000.

Wash., Spokane—Whiteworth College plans 3-story science building. Estimated cost, $100,000.

Calif., Hanford—City votes July 7 on $40,000 bonds for school. Noted Apr. 20.

Calif., San Francisco—Loyal Order of Moose plans home. Estimated cost, $500,000. George E. Crother, Chn. Ways and Means Com.

Calif., South San Francisco—City voted $66,000 bonds for high school.

Calif., Whittier—(Official)—Friends Congregation receiving bids about Aug. 15 for church. Estimated cost, $60,000. H. M. Patterson, 324 O. T. Johnson Bldg., Los Angeles, Arch. Noted June 8.

N. S., Halifax—Board of School Commissioners plan school on Morris St. Estimated cost, $120,000. W. J. Baush, 60 Bedford Rd., Arch.

N. B., Fredericton—Estate of late Donald Fraser prepared plans for 2 memorial buildings. Estimated cost, $100,000.

Que., Montreal—Canadian Theater Co. plans theater. Estimated cost, $250,000. J. C. Duffield, Pres. City Gas Co., London, Ont., interested.

Que., St. Damase—P. Levesque, 115 St. John St., Montreal, preparing plans for church. Estimated cost, $60,000.

Ont., Pembroke—W. C. Keighley, Box 508, prepared plans for school. Estimated cost, $40,000.

Bids In and Contracts Awarded

Maine, Machias—Eastern Trust Co. awarded contract for bank building to GEORGE H. WILBUR & SON, Bangor.

Mass., Brockton—Contract for building for Kennedy Clothing Co., 32 Summer St., Boston, awarded to HORTON & HEMENWAY CO., 683 Atlantic Ave. Estimated cost, $120,000.

Mass., Lynn—Charles W. Wright, Lynn, at $149,000, submitted lowest bid for Conomo School. Noted Mar. 16.

Mass., Stoneham—H. S. Molsey, 44 Bromfield St., Boston, awarded contract for office building to E. RADDING, INC., 580 Mass Ave., Cambridge.

Conn., Torrington—Torrington National Bank awarded contract for 1-story bank building to HOGGSON BROS., 485 5th Ave., New York, N. Y. Estimated cost, $80,000.

N. Y., Binghamton—Peoples Trust Co., 81 Court St., awarded contract for 5-story bank and office building to PARSONS BROS. CO., INC., Security Bldg.

N. Y., Kew Gardens—(Jamaica post office)—Kew Gardens County Club awarded contract for club house to DAVID HILL, Ozone Park, Long Island. Estimated cost, $40,000. Noted May 25.

N. Y., New York—(Borough of Brooklyn)—(Official)—Low bids received June 21 for reconstructing and improving Kings County courthouse at Fulton and Livingston St. as follows: P. J. Carlin, 1123 Broadway, Manhattan, $563,000; Daniel A. Gerber, $565,200; P. F. Kenney Co., $563,900. Noted June 15.

N. Y., Ogdensburg—Ogdensburg City Hospital awarded contract for 4-story, 50x120-ft. addition to hospital to E. K. FENNO, North Beech St., Syracuse. Estimated cost, $90,000.

N. Y., Troy—William E. Martin Co., Front St., submitted lowest bid for 4-story, 111x120-ft. school for St. Marys Church. Estimated cost, $100,000. Noted Mar. 30.

N. J., Jersey City—City awarded contract for school on Sussex St. to CANE CO., at $133,333. Noted May 11.

N. J., Newark—Market and Beaver Realty Co. awarded contract for theater, store and loft building to JARDIN & CO., 507 5th Ave., New York, N. Y.

N. J., Penns Grove—Upper Heck Township awarded contract for 2-story school to McCLOSKEY & BAHLA, Hale Bldg., Philadelphia, Penn. Estimated cost, $40,000. Noted June 8.

Penn. Philadelphia—(Official)—Board of Education awarded contract for Oliver Wendell School at 55th and Chestnut St to WARREN MOORE & CO., Commercial Trust Bldg., Philadelphia, at $214,180. Noted May 11.

Penn., Philadelphia—Evangelical Lutheran Congregation of Good Shepherd, 62nd and Jefferson St., awarded contract for church to E. E. HALLENBACK, INC., 15th and Race St.

Ohio, Cleveland—Rumanian Benevolent Union, Branch No. 17, awarded contract for clubhouse at Stone and Herman St. to S. G. SAVICH, 1107 Addison Rd.

Ohio, Leesburg—(Official)—Board of Education awarded contract for grade school to F. K. VAUGHN BUILDING CO., Hamilton. Noted June 1.

Ohio, Steubenville—Ohio Valley Hospital awarded contract for 2-story, 55x153-ft. hospital to GUY JOHNSON, Toronto, Ont. Estimated cost, $70,000. Noted Nov. 25.

Ill., Sullivan—Board of Education awarded contract for school to ENGLISH BROS., Lincoln Bldg., Champaign. Estimated cost, $80,000. Noted Mar. 16.

Ill., Urbana—(Official)—Contract for 3-story women's residence hall for University of Illinois awarded to A. W. STOOLMAN, Champaign, at $105,650. Noted Mar. 9 and Mar. 23 under Champaign.

Wis., Ripon—City awarded contract for municipal opera house and armory to C. R. MEYER & CO., Oshkosh. Estimated cost, $50,000. Noted June 22.

Iowa, Ames—Masonic Lodge awarded contract for lodge and newspaper building to F. H. COATS, Ames. Noted May 18.

Iowa, Audubon—Independent School District awarded contract for 2-story high school to J. P. RIDDLE, Creighton, Neb. Estimated cost, $55,000. Noted Apr. 27.

Iowa, Sioux City—Trinity College awarded contract for dormitory to COOMER & SMALL, 312 United Bank Bldg. Estimated cost, $75,000. Noted May 18.

N. D., Mandan—Mandan School District awarded contract for high school to A. LARSSON, Mandan.

Tex., Ft. Stockton—Contract for high school awarded to E. H. HARRELL & CO., at $43,350. Noted Apr. 13.

Tex., Groveton—See item under "Streets and Roads."

Tex., Lampasas—City awarded contract for school to J. H. WAGGONER, Lampasas.

Tex., Lometa—City awarded contract for school to J. F. DREW, Lometa.

Tex., Plainview—City awarded contract for high school to J. P. MAXEY, Plainview. Estimated cost, $50,000. Noted May 25.

Tex., Wichita Falls—City awarded contract for courthouse to LISLE-DUNNING CONSTRUCTION CO., at $200,500. Noted Mar. 16.

Idaho, Twin Falls—School Board awarded contract for school to NORTH PACIFIC CONSTRUCTION CO. Estimated cost, $75,000. Noted June 15.

Ore., Baker—(Official)—City awarded contract for high school to G. H. WAALE, Baker, at $85,267. Noted May 25.

Calif., Los Angeles—See item under "Railways."

Ont., Galt—Bell Telephone Co. awarded contract for building to P. H. SECORD & SONS, Brantford. Estimated cost, $80,000. Noted June 22.

TRADE PUBLICATIONS

Carrier Generator Cooler. Carrier Air Conditioning Co. of America, Buffalo, N. Y. Bulletin No. 253. Pp. 24. 6x9 in. This describes and illustrates the cooling and cleaning of air for generator and transformer ventilation.

Chain Belt Traveling Water Screens. Chain Belt Co., Milwaukee, Wis. Bulletin No. 64. Pp. 8. 6x9 in. This describes water screens designed primarily to remove refuse and foreign material from water before it enters power plants or any industrial plant requiring large quantities of clean water.

Concrete Roads and Pavements. Trussed Concrete Steel Co., Youngstown, Ohio. Catalog. Pp. 128. 5x7½ in. This is the 1916 edition of the Kahn Road Book and describes the reinforcing materials made by this company. A lot of data is included which ought to be helpful to engineers, contractors and all others interested in building concrete pavements and roads.

Steel Tanks. Pittsburgh-Des Moines Steel Co., Pittsburgh, Penn. Pamphlet. Pp. 24. 5½x8½ in. Illustrated. This covers specially tanks for fire protection and industrial service and contains engineering and cost data which should be of value to executives of large manufacturing plants and industrial engineers.

Wonder Concrete Mixers. Waterloo Cement Machinery Corporation, Waterloo, Iowa. Catalog. Pp. 24. 8x10½ in. This shows the new model mixers built by this company with and without folding track loaders.

Edward F. Terry has formed a corporation to be known as the Edward F. Terry Manufacturing Co. The company will carry on the business of manufacturing cranes, derricks, structural steel, etc. The business of the Terry & Tench Co., with the exception of the above departments will be carried on as usual. The offices of both companies will be in Grand Central Terminal, New York, N. Y.

WHARF, HOUSTON, TEX.

Bids were received by the city Apr. 28 for the construction of Wharf No. 4 from (A) HORTON & HORTON, Houston (awarded contract); (B) James Stewart & Co., Inc.; (C) Midland Bridge Co. The item bids were as follows:

	A	B	C
City of Houston Wharf, lump sum (a)	$256,900.00	$262,770.00	$367,000.00
Wharf as modified, lump sum (b)	259,400.00	259,835.00	367,000.00
50,000 cu.yd. excavation hauled away	.29	.30	.29
20,000 cu.yd. excavation and refill	.29	.48	.31
1,000 lin.ft. timber piling, plumb	.25	.22½	.34
1,000 lin.ft. timber piling, batter	.50	.26	.38
600 lin.ft. concrete piling, 30 ft. long	1.20	1.40	2.50
400 lin.ft. concrete piling, 20 ft. long	1.20	1.50	2.50
30 M b.m. timber sheet piling, 30-36 ft.	50.00	50.00	56.00
20 M b.m. timber sheet piling, 28-24 ft.	45.00	47.00	50.00
10 M b.m. timber sheet piling, 22-16 ft.	40.00	44.00	43.00
10 M b.m. decking, 4 in. and underground	37.00	42.00	38.00
1 M b.m. dim. timbers in platforms	60.00	52.50	40.00
1 M b.m. dim. timbers in fender system	60.00	52.50	40.00
100 cu.yd. concrete, Class 1	7.50	7.50	12.50
200 cu.yd. concrete, Class 2	7.00	6.50	11.00
100 cu.yd. concrete, Class 3	6.50	6.25	10.00
100 cu.yd. concrete, Class 4	6.00	6.00	7.50
40,000 lb. reinforcement	.05	.04½	.05
5,000 sq.ft. form surface	.10	.11	.15
1,000 sq.ft. form surface	.07	.12½	.14
1,000 sq.ft. form surface	.12	.15	.15
2 Moor. cavels	20.00	.18	10.00
10,000 lb. tie rods	.06	.07	.06
50 inserts	1.50	.50	.50
100 cu.yd. trenching	1.00	.75	.60
100 lin.ft. 24 in. vitrified sewer pipe	1.65	1.75	2.00
20 lin.ft. 15-in. vitrified sewer pipe	.90	.75	.80
30 lin.ft. 8-in. vitrified sewer pipe	.40	.60	.30
20 lin.ft. 6-in. vitrified sewer pipe	.26	.50	.29
40 lin.ft. 5-in. c.-i. soil pipe	.45	1.00	.70
40 lin.ft. 5-in. c.-i. d. s. No. 20 g.	.25	.32	.15
50 lin.ft. 6-in. c.-i. gutter No. 20 g.	.30	.35	.25
10 lb. 16 oz. copper flash	.60	.65	.60
100 sq.ft. fixed M. sash glazed	.60	.60	.80
100 sq.ft. vent. M sash glazed	.75	.75	1.00
100 lin.ft. 10-in. c.-i. water pipe	1.50	1.75	1.60
100 lin.ft. 4-in. c.-i. water pipe	.75	.75	.60
2 col. fire hydrant	37.00	95.00	50.00
100 sq.yd. 2-in. asphalt pavement	1.00	1.00	1.00
10 sq.yd. 3-in. vertical fibre pavement	1.45	1.75	3.20
2 standard single inlet	26.00	25.00	8.00
500 lb. nails, spikes, bolts, etc	.10	.06	.04
200 lin.ft. R.R. track	2.50	1.85	3.30
2 switches	250.00	375.00	180.00
50 cu.yd. r. shell ballast	1.50	1.55	1.50
1 M ft. b.m. cypress lumber	50.00	60.00	40.00
10 square roofing	5.00	5.00	5.00
100 sq.yd. 8-in. shell roadway	.50	.35	.60
100 lin.ft. branch circuit	.15	.16	.50
5 ceiling outlet box	5.50	1.00	6.50
5 bracket outlet box	5.50	1.00	6.50
5 switch box	1.75	1.00	2.00
5 local switch	2.20	1.50	2.50
5 plugging box	15.00	7.50	20.00
5 circuit connection	11.50	4.00	12.00
2,000 man-hour labor-skilled	.80	.85	.75
4,000 man-hour labor-unskilled	.30	.32	.30
1,000 team hour teams	.70	.75	.70
Extended totals with (a)	$296,696	$305,571	$413,607
Extended totals with (b)	$299,196	$302,636	$413,607

The Engineer Depot of the U. S. Army is obtaining prices on a complete line of equipment for field service including shovels, axes, picks, saws, hammers, anvils, jacks, surveying instruments and general hardware. Captain Dougherty is at the Army Bldg., Room 711, 39 Whitehall St., New York, N. Y., in charge of these emergency purchases.

The Jeffrey Manufacturing Co., Columbus, Ohio, announces the re-opening of its Northwestern Branch Office at Seattle, Wash., and the appointment of Percy E. Wright, Consult. Mech. Engr., as District Manager for Oregon, Washington, Alaska, British Columbia and Alberta. Mr. Wright, who has been in the Northwest since 1910, and whose connection with this company, dates back to 1902, has had a wide and varied experience and training in the handling of the Jeffrey Line in the Engineering, Construction, and Sales Departments, which will enable him to be of great assistance to customers in solving elevating, conveying and transmission problems.

Arthur D. Little, Ltd., Chemist, Engr. and Mgr., 137 McGill St., Montreal, Que., has been granted a Dominion charter as a corporation organizer and equipped for the service of Canadian industry and the study and development of Canadian Resources. The special facilities of the new company will be supplemented by the entire staff organization and equipment of Arthur D. Little, Inc., 93 Broad St., Boston, Mass.

F. R. Blair, formerly Secretary, Treasurer and Sales Manager of the S. K. F. Ball Bearing Co., has resigned and has become President of the F. R. Blair & Co., Inc., with offices at 50 Church St., New York, N. Y.

The Wilmington Iron Works, Wilmington, N. C., has opened an office at 1 Madison Ave., New York, N. Y. Herbert Crapster, Treas. of the Valve Sales Co., will be the New York Manager of the Wilmington Iron Works.

Japan plans to spend $297,000,000 on railroad construction. It is planned to change all the narrow to standard broad gage tracks and work will start on the main trunk line which connects Tokio with Shimonoseki, a distance of about 800 mi. This is the line which connects with the Corea and the Siberian R.R. to Europe. The reconstruction expense of this line, covering a series of 12 years, is estimated at $148,500,000. The reconstruction of the other line to the Empire is estimated to cost the same figure, the work extending over a period of 25 years. Dr. J. Soyeda, Pres. of the Imperial Railroad Board, is of the opinion that the plan should be carried out as soon as possible, because it means that the annual improvement expenses can be dispensed with.

Contracts to Be Let

Rate: $2.40 per inch per insertion

Bids received until July 8, 1916.

Street Paving

Lakewood, N. J.

The Township Committee of the Township of Lakewood, in the County of Ocean and State of New Jersey, will receive on Saturday, July 8, 1916, at one (1) o'clock in the afternoon of said day, at the town hall at Lakewood, Ocean County, New Jersey, sealed alternative proposals for the paving of approximately 13,433 yards on Clifton Avenue and Second Street in the said township of Lakewood, in accordance with the plans and specifications for the respective classes of paving.

Proposal blanks and copies of specifications may be obtained and plans examined at the office of the Township Clerk at No. 248 Second Street, Lakewood, N. J., or at the office of engineers, Vermeule & Bishop, 203 Broadway, New York City. Proposals must be made on the blank form provided.

Proposals will be asked for on three different classes of pavement and the award of contract if awarded shall be made only to the lowest responsible bidder in the class of pavement selected by the Township Committee and whose proposal shall comply with all the provisions and requirements to render it formal.

Each proposal must be accompanied by a certified check on an incorporated bank or trust company payable to the Township of Lakewood, in the County of Ocean, for five percentum of the amount of the proposal, as a guarantee that if such proposal is accepted the bidder will within ten days after notice of such acceptance enter into a contract with the said Township of Lakewood for the performance thereof and file a bond in the penal sum of fifty per centum of the amount of said proposal, conditioned for the faithful performance of said work in strict compliance with the said plans and specifications and to the satisfaction of the said Township Committee, with surety approved by the said Township Committee.

Checks accompanying alternative proposals shall be for five per centum of the amount of the highest alternative bid.

All provisions contained in the specifications relative to the preparation, filing form and submission of proposals shall be strictly observed.

The right is reserved to reject any or all bids. (Signed)

GEO. H. HURLBURT,
Township Clerk.

Dated June 21, 1916.

Bids received until July 5, 1916.

Street Paving

Harrisonburg, Va.

Bids will be received by the City of Harrisonburg, Va., for constructing Vitrified Block and Asphalt Block pavement until noon, July 5, 1916. Approximate quantity 18,000 square yards.

Specifications and blank forms from City Clerk. City reserves right to reject any or all bids.

E. A. ZIGLER,
Chairman Street Committee.

Bids received until July 26, 1916.

Levees and Ditches for Combahee Corporation

Charleston, S. C.

The Combahee Corporation will receive sealed bids at its office in the Consolidated Company Building, Charleston, S. C., up to noon of July 26, 1916, for the construction of the following:

Six and nine-tenths miles of levee with a total yardage of about 190,000, and six miles of open ditch with a total yardage of about 80,000, according to the specifications and estimates of the Engineer.

Bids will be accepted for the work as a whole or for the levee and ditches separately. The right is reserved to reject any and all bids, and to waive any informalities in the bids received.

No bids will be considered unless accompanied by a detailed statement of the sizes and types of dredge or excavator that the contractor proposes to use on the various classes of work.

No bids will be considered unless accompanied by a certified check for not less than five per cent. of the bid.

The bidder to whom award is made will be required to enter into a written contract with the Combahee Corporation with good and approved security, in an amount of twenty-five per cent. of the amount of the contract, within thirty days after being notified of the acceptance of his proposal. Parties making bids are to be understood as accepting the terms and conditions contained in such form of contract. For further general information see Engineers' report on file in the Office of the Company in Charleston, or in the Office of F. G. Eason, U. S. Drainage Engineer, Postoffice Bldg., Charleston, S. C., or in the Office of C. W. Okey, U. S. Drainage Engineer, Tulane University, New Orleans, La.

June 23, 1916.

COMBAHEE CORPORATION.
C. J. BENDT, Sec. and Treas.

Bids received until July 7, 1916.

Construction of Sanitary Sewers

DEPARTMENT OF WORKS
Oswego, N. Y., June 20th, 1916.

Proposals will be received by the Department of Works of Oswego, N. Y., up to 2 p.m., July 7th, 1916, and then opened for the following sewer construction:

5,500 feet of 8" and 10" vitrified tile sewers with the necessary "Y" branches, manholes, flush ends, etc.

Plans and specifications and any further information on the above work may be obtained from the City Engineer on payment of three dollars.

The work will be under one contract and the proposals submitted therefor must be accompanied by certified check for ten percent of the amount of the proposal.

The Department of Works reserves the right to reject any and all bids.

CHARLES W. LINSLEY,
Commissioner of Works.

Bids received until July 14, 1916.

Pumping Engine

Erie, Pa., June 16th, 1916.

Sealed proposals for the design, construction and erection of a twenty million gallon turbine-driven centrifugal condensing pumping engine, addressed to the Commissioners of Water-Works in the City of Erie, will be received at the Water-Works Office, City Hall, Erie, Pennsylvania, until twelve o'clock noon, the 14th day of July, 1916, and will be opened and read publicly.

All bids shall be made upon the blank forms of the proposal blank contained in the pamphlet with the instructions to bidders, contract and specifications to be obtained on and after the 26th day of June, 1916, at the Office of the Commissioners, City Hall, Erie, Penna., and at the office of Chester & Fleming, Engineers, Union Bank Building, Pittsburgh, Penna.

Each proposal shall be accompanied by a certified check for One Thousand Dollars ($1,000.00), said check to be made payable to the Secretary, Commissioners of Water-Works in the City of Erie, Pa., and to be conditioned that if the bid is accepted, a contract will be entered into and the performance of same secured within ten (10) days after notification of the acceptance of the bid.

Commissioners do not bind themselves to accept the lowest bid, but reserve the right to reject any and all bids or select such bid as they may deem for the best interests of the City of Erie.

Upon the entering into a contract, or the rejection of all bids, checks will be returned to the bidders.

Copies of contract and specifications can be obtained at the office of the Commissioners or their Engineers, and intending bidder upon deposit of ten ($10) dollars will be entitled to two copies. Proper receipt for each such deposit will be given and the money will be refunded upon the return in good condition of the above, or in case one copy is used for bidding, the other will become the property of the bidder and deposit returned.

COMMISSIONERS OF WATER-WORKS
IN THE CITY OF ERIE, PENNA.
By GEORGE C. GENSHEIMER,
Secretary.

CHESTER & FLEMING, Engineers,
Union Bank Building, Pittsburgh, Pa.

Bids received until July 20, 1916.

Sewer Proposals

City of Bridgeport, Connecticut.

Sealed proposals will be received until 7:30 P.M. of July 20th, 1916, at the office of the Paving and Sewer Commission, Room 22, City Hall, Bridgeport, Conn., for the construction of about 9,400 ft. of 60-inch, 66-inch, 72-inch sewer, average cut about 24 ft. Plans and specifications can be obtained from Alfred H. Terry, City Engineer, Room 20, City Hall, after June 26th, on payment of $2.00.

BERNARD KEATING, Secretary.

Bids received until July 17, 1916.

Street Improvements

Westfield, N. J.

Sealed proposals will be received by the Council of the Town of Westfield, N. J., at the Town Hall, on Monday, July 17th, 1916, at eight o'clock P.M., for improving sections of Stanley Avenue, Tremont Avenue, South Avenue, Mountain Avenue and North Avenue in said Town.

The Engineer's approximate estimate of the amounts of work to be done is as follows:

7,000 square yards of macadam pavement
10,000 square yards of cement concrete pavement
5,500 lineal feet of underdrains
5,100 lineal feet of concrete curb and gutter.

Also incidental grading, resetting stone curb on concrete, resurfacing old macadam, constructing catch basins and connections and building culverts.

Each proposal must be accompanied by a certified check for $1,000, drawn to the order of the Treasurer of the Town of Westfield, N .J., as an evidence of good faith, and the successful bidder will be required to furnish a surety company bond in a penal sum equal to the estimated cost of the work to guarantee the faithful performance of the contract.

Plans, specifications and forms of proposal may be obtained at the office of A. W. Vars, Town Engineer, Town Hall, Westfield, N. J.

The Council reserves the right to reject any or all bids, to accept any bid, or to waive defects in bids, as they may deem for the best interest of the Town.

CHARLES CLARK, Town Clerk.
June 19, 1916.

Bids received until July 5, 1916.

Paving

Auburn, N. Y.

Sealed proposals will be received by Hon. Mark I. Koon, Mayor, up to 8 o'clock p.m., July 5, 1916, for the paving of Fort, Grover and John streets and the resurfacing of North and State streets. Approximate sq.yd. quantities are 2,500 in Fort street, 4,300 in Grover street, 1,60(in John street, all on 6-inch concrete base. Curbing will approximate 5,350 lineal feet. Proposals for foregoing streets will be received on following material: Asphalt, stone-filled asphalt, bitulithic and vitrified brick. North and State streets will approximate 7,700 sq.yds. of resurfacing with stone-filled asphalt and 1,300 sq.yds. of vitrified brick. Bidders may submit proposals on all or any one of the streets. Certified checks will be accepted with the proposals as follows: North, State and Grover streets, each $500; Fort street, $300; John street, $200, or a bond equal to 10% of the gross amount of the contract each on Grover, Fort and John streets and 50% each on North and State streets. Plans and specifications can be obtained from Thomas B. Bergan, City Engineer, upon payment of $10; said sum to be returned upon the return of the plans and specifications.

J. S. HANLON, City Clerk.

Exacvation and Concrete Work

The Conners Bros. Co., 64 West 88th St., New York, N. Y., has 20,000 yds. of excavation and 8,000 yds. of concrete work to let.

Bids received until July 6, 1916.

Furnishing Water Pipe and Necessary Specials

Michigan City, Ind.

The Board of Public Works of the City of Michigan City, Ind., will receive sealed proposals, until 10 o'clock a.m., July 6, 1916, for furnishing water pipe and necessary specials, as follows:

100 tons of 6-in. water pipe, Class B.
11¼ tons of 4-in. water pipe, Class B.
3 tons of lead.
1,000 lb. of Jute.

Also special castings, 6-in. and 4-in valves, hydrants, valve boxes, tees, crosses, sleeves, plugs, etc., necessary to install the pipe aforesaid.

Bids may be for all or any part of the above material. Each bid must be accompanied by a certified check, made payable to the City Treasurer, for 20 per cent. of bid, as surety for the execution of a contract.

The City reserves the right to reject any or all bids or any part of any bids.

ALEXANDER SPYCHALSKI,
City Clerk.
Michigan City, Ind., June 17, 1916.

Bids received until July 12, 1916.

Water Works

Salisbury, N. C.

Sealed proposals will be received by the Board of Water Commissioners of Salisbury, N. C., until 3 o'clock p.m., July 12th, 1916, for constructing a new filtration plant and a new source of water supply.

Works will embrace laying 5½ miles cast-iron pipe, either 14 or 16 inches in diameter, furnishing and installing motor driven centrifugal pumps, filtration plant, filter house, reservoir, power station, gate valves, tower and tank, transformers and other appurtenances.

Plans and specifications will be on file, and may be seen at the office of the Board at Salisbury, N. C., and at the office of the Engineer in Winston-Salem, N. C., and copies of specifications, forms of proposals, etc., may be obtained from the Engineer.

The right is reserved to reject any, or all, bids.

MAYOR WALTER H. WOODSON,
Chairman.
J. W. NEAVE, Superintendent.
Engineer:
J. L. LUDLOW,
Winston-Salem, N. C.

Bids received until July 10, 1916.

Street Improvements

Beaver Falls, Pa.

Sealed proposal will be received by the Town Council of the Borough of Beaver Falls, Pa., until eight o'clock P.M., Tuesday, July 10th, for the paving and improving of Seventh Avenue in said Borough between Twentieth Street and Twenty-Seventh Street.

The approximate quantiites are as follows:

Paving.....	13,500 Sq.Yards.
Grading.....	5,000 Cu.Yards.
Curb and Gutter....	6,000 Lineal Feet.

Catch Basins, Sewer Connections and other appurtenances.

Certified check required, One Thousand Dollars.

The right is reserved to reject any or all bids. Further details will be furnished upon application to

CARL S. DONALDSON,
Borough Engineer.

Bids received until July 13, 1916.

Water Tube Boilers

White Plains, N. Y.

Public Notice Is Hereby Given that the Building Commission of Westchester County have caused plans, specifications and Notice to Bidders to be prepared for the furnishing and installation of high-pressure water-tube boilers for the Westchester County Penitentiary and Alms house at East View, N. Y., and that bids will be received by said Commission at the City of White Plains, N. Y., on the 13th day of July, 1916, in accordance with the provisions of such plans, specifications and Notice to Bidders, and in compliance therewith, copies of said plans and specifications are on file with the Commission, 15 Court Street, White Plains, N. Y., where they may be seen and used, or they may be obtained from the Clerk of the Building Commission, 15 Court Street, White Plains, N. Y., or from the Consulting Engineers, Clark, MacMullen & Riley, 101 Park Avenue, New York City.

Bids must be submitted on the forms attached to the Notice to Bidders, and all of the requirements of the Notice to Bidders must be complied with.

Dated June 14th, 1916.

ROBERT S. BREWSTER,
ARTHUR W. LAWRENCE,
GEORGE E. MERTZ,
Building Commissioners of Westchester County.

Bids received until July 26, 1916.

Pumping Plant for Combahee Corporation

Charleston, S. C.

The Combahee Corporation will receive sealed bids at its office in the Consolidated Company Building, Charleston, S. C., up to noon of July 26, 1916, for the furnishing of the following equipment for a pumping plant and constructing the same complete and ready for operation, for the purpose of land drainage:

Two pumping units, each composed of internal combustion engine, pump, suction and discharge pipes, the necessary auxiliaries, all having the same capacity, the total capacity of the two units to be 35,000 gallons per minute at a static head of 3 feet.

Only bids for the entire plant erected complete will be considered. The right is reserved to reject any and all bids, and to waive any informalities in the bids received.

No bids will be considered that do not follow the form of proposal accompanying the specifications for the pumping plant. The written acceptance by the Combahee Corporation of any proposal made will, with the proposal, form the contract between the Corporation and the parties making the proposal.

For further general information see Engineers' report on file in the office of the Corporation in Charleston, S. C., or in the office of F. G. Eason, U. S. Drainage Engineer, Postoffice Building, Charleston, S. C., or in the office of C. W. Okey, U. S. Drainage Engineer, Tulane University, New Orleans, La.

June 23, 1916.

COMBAHEE CORPORATION.
C. J. BENDT, Sec. and Treas.

U. S. ENGINEER OFFICE, Baltimore, Md.—Sealed proposals for dredging in Elk and Little Elk Rivers, Md., will be received here until 1:00 p.m., June 30, 1916, and then opened. Information on application.

Bids received until July 3, 1916.

Steel Bridges

Tulsa, Okla.

Sealed proposals will be received by the Board of County Commisioners of Tulsa County, Oklahoma, on Monday, July 3d, 1916, until 10 o'clock A.M., in the County Court House of Tulsa, Oklahoma, for the furnishing of material and construction of seventeen (17) steel bridges, of the dimensions and locations as follows:

90'x16' Steel Bridge located between Sections 25 and 26, Township 17 North, Range 13 East.
36'x16' Steel Bridge located between Sections 11 and 22, Township 22 North, Range 13 East.
36'x16' Steel Bridge located between Sections 1 and 12, Township 22 North, Range 12 East.
45'x16' Steel Bridge located between Sections 7 and 12, Township 17 North, Range 13 and 14 East.
60'x16' Steel Bridge located between Sections 15 and 16, Township 16 North, Range 13 East.
80'x16' Steel Bridge located between Sections 30 and 31, Township 20 North, Range 16 East.
20'x16' Steel Bridge located between Sections 6 and 7, Township 19 North, Range 14 East.
16'x16' Steel Bridge located between Sections 20 and 21, Township 20 North, Range 13 East.
20'x16' Steel Bridge located between Sections 16 and 21, Township 20 North, Range 13 East.
16'x16' Steel Bridge located between Sections 5 and 8, Township 18 North, Range 14 East.
16'x16' Steel Bridge located between Sections 33 and 34, Township 19 North, Range 14 East.
70'x16' Steel Bridge located in Section 31, Township 17 North, Range 15 East.
50'x16' Steel Bridge located between Sections 7 and 12, Township 17 North, Range 13 and 14 East.
60'x16' Steel Bridge in Section 12, Township 19 North, Range 10 East.
80'x16' Steel Bridge between Sections 5 and 8, Township 19 North, Range 10 East.
20'x16' Steel Bridge located between Sections 31 and 36, Township 22 North, Range 12 and 13 East.
36'x16' Steel Bridges between Sections 4 and 5, Township 21 North, Range 13 East.

As per plans and specifications on file in the offices of the County Clerk and County Engineer, in the Court House in Tulsa, Tulsa County, Okla. The Commissioners reserve the right to reject any and all bids; all bids to be accompanied by a certified check covering 10% of bids. By order of the Board of County Commissioners of Tulsa County, Oklahoma.

LEWIS CLINE,
County Clerk.

Bids received until July 6, 1916.

Reconstruction of Dam

Walden, N. Y.

Sealed bids will be received up to 5 p.m. of July 6th for the reconstruction of small dam (300 feet long, 10 feet high) belonging to the Walden Knife Co., at Walden, N. Y. Plans and specifications may be seen at the Engineer's Office, 43-45 Second Street, Newburgh, N. Y.

ALEX. THOMSON, JR.,
Consulting Engineer.

Bids received until July 10, 12, 14, 1916.

State Highway Work

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

Albany, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock P.M. on Monday, the 10th day of July, 1916, for the construction of highways in the following counties:

Albany	(two highways—0.17 and	0.88)
Cattaraugus	(approx.	4.73)
Cayuga	(approx.	4.39)
Chautauqua	(approx.	4.33)
Chemung	(approx.	4.14)
Chenango	(approx.	7.09)
Clinton	(approx.	10.46)
Dutchess	(approx.	0.56)
Essex	(approx.	1.76)
Fulton	(approx.	5.13)
Greene	(approx.	2.39)
Herkimer	(approx.	5.10)
Madison	(approx.	6.54)
Monroe	(approx.	2.92)
Nassau	(approx.	5.24)
Oneida	(approx.	6.15)
Otsego	(approx.	8.13)
Saratoga	(approx.	6.10)
Wayne	(approx.	3.67)
Westchester	(approx.	1.74)

ALSO FOR THE REPAIR OF THE FOLLOWING:

Erie	(one contract—surface treatment)
Fulton	(one contract—resurfacing)
Nassau	(one contract—resurfacing)
St. Lawrence	(one contract—resurfacing)
Ulster	(one contract—resurfacing)

Sealed proposals will also be received at 1 o'clock P.M. on Wednesday, the 12th day of July, 1916, for the construction of the following highways:

Albany	(two highways—3.23 and	5.62)
Cattaraugus	(approx.	2.17)
Cayuga	(approx.	3.89)
Chautauqua	(approx.	0.74)
Chenango	(approx.	2.91)
Essex	(approx.	4.95)
Fulton	(two highways—2.90 and	1.10)
Genesee	(approx.	7.60)
Madison	(approx.	5.65)
Monroe	(approx.	7.93)
Nassau	(approx.	3.09)
Oneida	(approx.	5.74)
Oswego	(approx.	0.36)
St. Lawrence,	(two highways—0.44 and	4.60)
Steuben	(approx.	5.76)
Wayne	(two highways—3.97 and	2.25

ALSO FOR THE REPAIR OF THE FOLLOWING:

Dutchess	(one contract—resurfacing)
Erie	(one contract—resurfacing)
Monroe	(one contract—resurfacing)
Niagara	(one contract—resurfacing)
Westchester	(one contract—resurfacing)

Sealed proposals will also be received at 1 o'clock P.M. on Friday, the 14th day of July, 1916, for the construction of the following highways:

Albany	(approx.	2.93)
Chautauqua	(two highways—5.65 and	3.90)
Chenango	(approx.	0.82)
Fulton	(two highways—2.80 and	3.74)
Genesee	(approx.	7.94)
Herkimer	(approx.	5.67)
Madison	(approx.	0.91)
Monroe	(two highways—3.69 and	5.27)
Nassau	(approx.	3.38)
Niagara	(approx.	2.38)
Onondaga	(approx.	5.55)
Oswego	(approx.	2.04)
Otsego	(approx.	7.87)
St. Lawrence	(approx.	11.16)
Ulster	(approx.	2.73)
Wayne	(two highways—1.88 and	6.41)
Westchester	(approx.	2.74)

ALSO FOR THE REPAIR OF THE FOLLOWING:

Cattaraugus	(one contract—resurfacing and surface treatment)
Delaware	(one contract—surface treatment)
Erie	(one contract—resurfacing)
Nassau	(one contract—resurfacing)

Maps, plans, specifications and estimates maye be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the Division Engineers in whose division the roads are to be improved. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "General Information of Bidders" on the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY, Commissioner.
I. J. MORRIS, Secretary.

Bids received until July 5, 1016.

Street Paving

Akron, O., June 22, 1916.

Notice is hereby given that sealed bids will be received at the office of the Director of Public Service, City Hall, until 12 o'clock noon, on the 5th day of July, 1916, as follows:

PAVING

Exchange Street from E. Market to Spicer St.
Exchange Street from Spicer to Main St.
Exchange Street from Main to Maple St.
Howard Street from Main to Federal St.
Howard Street from Federal St. to Little Cuyahoga River.

Each proposal must contain the full name of every party or parties making the same, and all persons interested therein, and must be accompanied by a certified check for Two Hundred ($200.00) Dollars, on a solvent bank in the City of Akron, as surety that if the proposal be accepted, a contract will be entered into.

All proposals must be delivered at the office of the Board of Control (Department of Public Service) previous to 12 o'clock noon on the day specified.

The City reserves the right to reject any or all bids.

45,000 sq.yds. of paving on Exchange Street.
10,900 sq.yds. of paving on Howard Street.

E. A. ZEISLOFT,
City Civil Engineer.

Bids received until July 6, 1916.

Street Work

Elizabeth, N. J.

Sealed Proposals will be received by the Board of Public Works of the City of Elizabeth, N. J., at 2 P.M., at the City Hall, on July 6, 1916, for 25,000 sq.yds. of new granite block pavement, 40,000 sq.yds. of Asphaltic Concrete Pavement and 20,500 sq.yds. of recut Trap Block.

Specifications and bidding blanks may be obtained by applying in person at the office of the undersigned.

THOMAS E. COLLINS,
City Engineer.

Bids received until July 13, 1916.

Rebuilding Essex Bridge

Salem, Mass., June 26, 1916.

Sealed bids for rebuilding the Essex Bridge over the Danvers River, between the Cities of Salem and Beverly, will be received by the County Commissioners of Essex County at their office in the Court House in Salem, Massachusetts, until 9:30 o'clock A.M. of Thursday, July 13, 1916, and then and there will be publicly opened and read.

The work will consist in removing all portions of the old pile structure, 1,508 feet in length, except the draw span; furnishing all material and labor and building in place thereof a wooden pile and timber bridge of a total length of about 820 feet, and solid filled approaches, with rip-rap slopes, and masonry abutments, together with granite block paved roadway and granolithic sidewalks on bridge and approaches.

Plans and specifications and form of contract may be seen at the office of the County Engineer in Salem, Mass., or plans and specifications will be furnished to prospective bidders upon payment of Five Dollars ($5.00), which will be returned to such as submit a bid.

Each bid must be accompanied by a certified check for Five Thousand Dollars ($5,000.00) and the successful bidder will be required to furnish a surety company bond in the amount of forty per cent. of the contract. Bids to be endorsed "Bid for Rebuilding Essex Bridge."

The right is reserved to reject any or all bids.

MOODY KIMBALL,
JAMES C. POOR,
J. M. GROSVENOR, JR.,
County Commissioners.

Bids received until July 18, 1916.

State Highway Work

STATE OF MARYLAND
STATE ROADS COMMISSION
601 GARRETT BUILDING
Baltimore, Md.

Sealed Proposals for building 8 sections of State Highway, aggregating about 15.59 miles in length, and 1 bridge, as follows:

Contract No. BC-9A—
BALTIMORE CITY:

One section of Liberty Heights Avenue from Earle Avenue to Calloway Avenue, about 1.34 miles in length. (Sheet Asphalt.)

Contract No. 01-16—
CARROLL COUNTY:

One section through Sykesville, about 0.75 of a mile in length. (Macadam Resurfacing, Oil Bound.)

Contract No. D-17
DORCHESTER COUNTY:

One section through Hurlock, about 0.93 of a mile in length. (Macadam or Concrete.)

Contract No. F-18A—
FREDERICK COUNTY:

One section of Emmetsburg Pike, north from Thurmont, about 4.00 miles in length. (Macadam Resurfacing, Oil Bound.)

Contract No. F-24
FREDERICK COUNTY:

One section through Jefferson, about 1.00 mile in length. (Macadam Resurfacing, Oil Bound.)

Contract No. M-10—
MONTGOMERY COUNTY:

One section of road from Olney to Snells Bridge, about 5.55 miles in length. (Macadam or Concrete.)

Contract No. M-13A—
MONTGOMERY COUNTY:

One section of road between Norbeck and Olney, about 1.00 mile in length. (Macadam Resurfacing, Oil Bound.)

Contract No. P-15—
PRINCE GEORGE'S COUNTY:

One section through Upper Marlboro, about 1.02 miles in length. (Concrete Roadway.)

BRIDGE.

Contract No. BC-9, Br.—
BALTIMORE CITY:

One 5-span reinforced concrete bridge, about 150 feet in length, along Liberty Heights Avenue over Western Maryland Railway.

will be received by the State Roads Commission, at its office, 601 Garrett Building, Baltimore, Maryland, until 12 M. on the 18th day of July, 1916, at which time and place they will be publicly opened and read.

Bids must be made upon the blank form contained in the book of specifications. Specifications and plans will be furnished by the Comission upon application and cash payment of $1.00 as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of Five Hundred ($500) Dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland respecting contracts.

The Commission reserves the right to reject any and all bids.

By order of the State Roads Commission, this 27th day of June, 1916.

E. H. ZOUCK, Chairman.
WM. L. MARCY, Secretary.

Bids received until July 19, 1916.

Water Meters

Halifax, N. S.

Sealed tenders, addressed to His Worship the Mayor, City Hall, Halifax, N. S., and endorsed "Tender for Water Meters," will be received at the office of the Clerk of Works until noon on Wednesday, the 19th day of July, 1916, for furnishing two thousand eight hundred (2,800) five-eighth inch (⅝") meters and three hundred (300) three-quarter inch (¾") meters in accordance with the specification made by the City Engineer.

Each tender must be accompanied by a properly certified cheque for the sum of one thousand dollars payable to the order of the City Treasurer of the City of Halifax, said cheque to be returned to the bidder unless he fails to execute the contract should it be awarded to him, within ten days of such award.

The City reserves the right to reject any or all tenders should it deem it advisable to do so, and reserves the right to award the contract as it deems best.

Copies of the specifications, forms of tender and all other information may be obtained on application to the City Engineer.

H. W. JOHNSTON,
Acting City Engineer.

PROPOSALS FOR WIRE, WIRE STRAND, WIRE CABLES, STAPLES, CLIPS, RUBBER HOSE AND MANILA ROPE—U. S. Engineer Office, Custom House, Memphis, Tenn.—Sealed proposals for furnishing and delivering galvanized wire, wire strand, wire cables, staples, clips, pure manila bolt rope and rubber hose will be received at this office until 11 A.M., July 3, 1916, and then publicly opened. Further information on application.

Bids received until July 14, 1916.

Street Paving

York, Pa.

Sealed bids for the portions of Reinecke Place, Newberry St., East Princess St., Rouse Ave., Edgar St., Poplar St., College Ave., Locust St., Prospect St., Duke St., W. King St., Penn St. Charles St., South St., Maple St., Clark Alley and Queen St., approximating 66,140 square yards of vitrified brick, sheet asphalt, bitulithic, wood block, concrete or any other known or approved paving material that has been in constant use upon a roadway for a period of at least five years, will be received by the city clerk at City Hall, York, Pa., until 2 o'clock on the 14th day of July, 1916.

The selection of the materials or material with which said paving shall be done will be made by the City Council after the bids shall have been opened. Separate bids will be received for the paving of each street with the various kinds of surfacing material. Each bid for each surfacing will be considered an independent proposition and the bidder may bid on one or more streets or materials as he sees fit. Bids for paving will include grading, laying of 6-in. concrete base and surfacing material.

Each paving bid must be accompanied by a certified check drawn to the order of L. C. Elliott, City Treasurer of York Pa., or by a bid bond each in the amount of 5% of the bid price of the improvement.

The City Council reserves the right to reject any and all bids. Forms of proposals, specifications, contract and bond will be furnished upon application to the City Hall, York, Pa.

C. A. BOYER,
Supt. of Streets and Public Improvements.
C. F. W. WALLOW, City Engineer.

Bids received until July 13, 1916.

Sewers

Woonsocket, R. I.

Sealed proposals endorsed "Proposals for Building Sewers" will be received by the Board of Sewer Commissioners, Woonsocket, R. I., at the office of said Board, City Hall, Main street, Woonsocket, R. I., until 5 o'clock P.M., Thursday, July 13th, 1916, for building and furnishing all material for about 2,600 feet of 8-inch, 800 feet of 10-inch and 1,300 feet of 12-inch sanitary sewer and appurtenances.

The Board will be in session at 4.45 o'clock P.M. on said date for the purpose of receiving said proposals, or they may be left at the office previous to that time, and at 5 o'clock said proposals will be publicly opened and read.

Each proposal must be accompanied by a certified check for the sum of five hundred ($500), made payable to the order of A. J. Follett, City Treasurer, as surety that if the proposal is accepted a contract will be entered into.

All material must be satisfactory to the City Engineer, and plans and specifications may be seen and blank form of contract and proposal obtained at the office of the City Engineer, City Hall, Main street, Woonsocket, R. I.

The right is reserved to reject any and all bids as the interests of the city may appear.

FRANK E. HOLDEN,
GEORGE H. VALOIS,
JOHN COSSEBOOM,
Board of Sewer Commissioners.
FRANK H. MILLS, City Engineer.

Bids received until July 18, 1916.

Intercepting Sewer

PASSAIC VALLEY SEWERAGE COMMISSIONERS.
NOTICE TO CONTRACTORS.

Notice is hereby given that the Passaic Valley Sewerage Commissioners have designated Tuesday, the eighteenth day of July, nineteen hundred and sixteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals, in writing for the construction of Section 22 of the Lawrence Street Branch Intercepting Sewer in the City of Paterson in the County of Passaic in New Jersey.

Particulars that may enable Contractors to judge of the character of the work are given below:

APPROXIMATE QUANTITIES.
Section 22.

Item 1.—Earth excavation and refilling in trench, for 36-inch concrete sewer.....350 Linear feet
Item 2.—Earth excavation and refilling, in trench, for 30-inch concrete sewer .....2,215 Linear feet
Item 3.—Earth excavation and refilling, in trench, for 15-inch vitrified pipe sewer, with concrete reinforcement, including pipe, etc., 670 Linear feet
Item 4.—Earth excavation and refilling, in trench, for 12-inch vitrified pipe sewer, with concrete reinforcement, including pipe, etc., 390 Linear feet
Item 5.—Earth excavation and refilling, in trench, for 8-inch vitrified pipe sewer, with concrete reinforcement, including pipe, etc., 340 Linear feet
Item 6.—Concrete masonry, in trench, Portland cement mortar, 1,200 Cubic yards
Item 7.—Brick masonry, in manholes, Portland cement mortar and appurtenant work..... 250 Cubic yards
Item 8.—Rock excavation, in trench, 50 Cubic yards
Item 9.—Excavation and refilling, etc., for special structures and reconstruction of local sewers....Lump sum
Item 10.—Furnishing and installing one set of sewage regulating apparatus .....Lump sum
Item 11.—Furnishing and erecting back water gates in seven local sewers .....Lump sum

Drawings, form of contract and specifications, and blank form for proposal, may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.
JOSEPH H. QUIGG, Clerk.
June 27, 1916.

Bids received until July 20, 1916.

To Building Contractors

Union Grove, Wis.

Sealed proposals will be received by the State Board of Control of Wisconsin at its office in the Capitol Building, Madison, Wisconsin, up to 2:30 o'clock P.M., Thursday, July 20, 1916, for furnishing all the material and labor necessary for the erection, construction and completion of the following buildings:

2—60-Patient Buildings
1—Superintendent's Residence
1—48-Patient Building
1—Cow Barn Building
1—Piggery
1—Incubator
1—Hennery
1—Corn Crib
1—Manure Pit

at the Southern Home for Feeble-Minded and Epileptic at Union Grove, Wisconsin, except the plumbing, heating and lighting, according to the plans and specifications prepared for said work by Robert Messmer and Brother, Architects, Milwaukee, Wisconsin.

Plans and specifications will be on file in the office of the State Board of Control of Wisconsin, Madison, Wisconsin; the office of Robert Messmer & Brother, Majestic Building, Milwaukee, Wisconsin; the office of the Builders' and Traders' Exchange, Milwaukee, Wisconsin; the office of the Builders' and Traders' Exchange, Chicago, Illinois; the office of the Builders' and Traders' Exchange, Racine, Wisconsin; the office of the Builders' and Traders' Exchange, St. Paul, Minnesota; and the office of O. A. Dieman, Superintendent of Construction, Union Grove, Wisconsin.

Each proposal must be accompanied by a certified check in the sum of at least two per cent. of the amount of the bid and made payable to the order of James C. Davidson, President, State Board of Control of Wisconsin, to be forfeited to the state in case the bidder or bidders chosen fail to enter into a contract for said work and give a proper bond to secure the performance of the contract.

Bidders will give a separate proposal on each of the buildings described in this notice and will also give a bid for the entire work.

This Board has forty to forty-five able-bodied convicts whose labor can be used in the construction of these buildings, which will be furnished to the contractor at the rate of $1.50 per day and the state will take care of the housing, feeding, clothing and guarding of these convicts. You will kindly indicate in your proposal whether you are willing to employ these convicts under the conditions stated.

Bids should be sealed and enclosed in an envelope, which should be enclosed in another envelope addressed to the State Board of Control of Wisconsin, Madison, Wisconsin, and on the envelope should appear the name and address of the bidder and also the words "Proposal for Home for Feeble-Minded Buildings."

This Board reserves the right to reject any or all bids or to accept any bid or combination of bids which it deems most advantageous to the state.

The Board has a limited number of plans and specifications which will be sent out to the bidders on application, provided that a deposit of $25.00 is made with the Board to secure the return of the plans.

Dated at Madison, Wisconsin, this 15th day of June, A.D. 1916.

STATE BOARD OF CONTROL OF WISCONSIN.
By J. O. DAVIDSON, President.

Bids received until July 10, 1916.

Sewerage System

Sparta, Ill.

Sealed proposals will be received until 2 P.M., July 10th, 1916, and then publicly opened, by the Board of Local Improvements of the City of Sparta, Illinois, for the construction of a sanitary sewer and disposal plant including about 12 miles of 8- 10- and 12-inch vitrified clay sewer pipe. Estimated cost $54680. Certified check, 10%.

The right is reserved to reject any and all bids.

Plans and specifications are on file at the office of the City Clerk.

JAMES F. SWAIN, City Clerk.

Bids received until July 17, 1916.

Street Paving

Fairfield, Ill.

Bids will be received until noon, July 17th, 1916, for the improvement, known as Central Paving District, in the City of Fairfield, Ill., consisting of approximately the following amounts:

19,478 sq.yds. Vit. Brick Paving, on 5" Cement Concrete Base, with one and one-half inch sand cushion, Expansion Joints, and Cement Grout Filler.
10,444 lineal feet combined Curb and Gutter on 6" Gravel Base.
8,547 cubic yards Excavating and Grading, and preparing subgrade.
491 lineal feet of 6"x18" Concrete Curb on Alley wings.
270 lineal feet of 7"x15" Concrete Marginal Curb.
800 feet of 2½"x12" Oak Header Marginal Curb.
80 lineal feet 9"x12" Box Gutter.
225 lineal feet of 36"x36" Concrete Box Drain.
440 lineal feet of 48"x36" Concrete Box Drain.
115 lineal feet of 72"x48" Concrete Box Drain.
215 lineal feet of 84"x48" Concrete Box Drain.
180 lineal feet of 18" sewer pipe, with all fittings, cement joints.
306 lineal feet of 12" sewer pipe, and fittings, cement joints.
12 Inlets complete in place, with cast-iron covers.
4 Inlets complete, with cast-iron covers, set in top of slab of box gutter above inlet.

Proposals must be made on blanks furnished by said Board, and can be obtained from the City Clerk, and must be accompanied by cash or a certified check, payable to the order of A. J. Poorman, President of the Board of Local Improvement, in his official capacity, and certified by a responsible bank, for an amount not less than ten per cent. of the aggregate amount of the proposal. No bid will be accepted without the party offering it shall furnish satisfactory evidence to the said Board of Local Improvements that they have the necessary facilities, ability and financial resources to fulfill the conditions of the contract in a prompt and satisfactory manner.

Bidders will examine the Ordinances, Maps, Plans, Profiles and Specifications, and also the locality in which the work is to be done, and judge for themselves all the circumstances and conditions affecting the nature and cost of said work.

The contractor shall be paid in Bonds, which shall bear interest at the rate of 5%.

The Board of Local Improvements reserves the right to reject any and all bids as authorized by law.

A. J. POORMAN, President.
W. L. McFARLAND, Secretary.
JOHN SHEEHORN,
Supt. of Streets.
Dated Fairfield, Ill., June 26th, 1916.

Bids received until July 28, 1916.

Tile Drainage System

OFFICE OF THE BOARD OF SUPERVISORS OF SEVIER COUNTY DRAINAGE DISTRICT NO. 1
Richfield, Utah.

Sealed proposals will be received until 6 o'clock P.M., on Friday, July 28, 1916, to be opened at 8 o'clock P.M. of the same day, for the installation of a tile drainage system within and for Sevier County Drainage District No. 1.

Bids for contract are to be accompanied by certified checks in the amount of five (5%) per cent. of the sum bid.

Copies of instructions to bidders, plans and specifications and forms of contract and bond will be furnished by the undersigned at the office of H. N. Hayes, Peterson Block, Richfield, Utah; or by the engineers, Brown & Kleinschmidt, 306 Dooley Block, Salt Lake City, Utah, upon receipt of a deposit of five ($5.00) dollars.

The Board of Supervisors reserve the right to reject any and all bids.

L. A. WILSON,
Secretary, Board of Supervisors.

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U. S. ENGINEER OFFICE, Baltimore, Md.—Sealed proposals for dredging in Susquehanna River, Md., will be received here until 1:00 p.m., July 11, 1916, and then opened. Information on application.

PROPOSALS FOR THE PURCHASE OF LOCOMOTIVES offered for sale by The Panama Canal, and which are no longer needed.—Sealed proposals will be received at the office of the General Purchasing Officer, The Panama Canal, Washington, D. C., until 10:30 a.m., August 23, 1916, at which time they will be opened in public, for purchasing the above-mentioned locomotives. Blanks and general information relating to this Circular (No. 1057) may be obtained from this office or the offices of the Assistant Purchasing Agents, 24 State Street, New York City; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.; also from the U. S. Engineer Offices in the following cities: Seattle, Wash.; Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburgh, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky.; Mobile, Ala., and Galveston, Tex.; Commercial Club, Kansas City, Mo.; Chamber of Commerce, Quincy, Ill., and Commercial Club, Tacoma, Wash. EARL I. BROWN, Major, Corps of Engineers, U. S. A., General Purchasing Officer.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., June 20, 1916.—Sealed proposals will be opened in this office at 3 p.m., August 1, 1916, for the construction of the United States post office at Newburyport, Mass. Drawings and specifications may be obtained from the custodian of the site at Newburyport, Mass., or at this office, in the discretion of the Supervising Architect. Jas. A. Wetmore, Acting Supervising Architect.

Bids received until July 3, 1916.

Gravel Roads

Wickliffe, Ky.

Sealed bids for the construction of 38.39 miles of gravel roads embracing the following quantities will be received until 1 o'clock P.M., July 3rd, 1916:

Earth excavation .....77,881.5 Cu.Yds.
Gravel for surfacing.....97,304.3 Cu.Yds.
Reinforced concrete ..... 2,190.6 Cu.Yds.
Hauling and placing 12-inch Cor. pipe, 292 Lin.feet.
Hauling and placing 18-inch Cor. pipe, 958 Lin.feet.
Hauling and placing 24-inch Cor. pipe, 16 Lin.feet.
Steel reinforcing for concrete culverts, 119,803.58 Lbs.
Shaping and rolling subgrade, 38.39 miles.

Plans and specifications on file in the offices of the county clerk at Wickliffe, Ky., and the Commisisoner of Public Roads at Frankfort, Ky.

G. O. JOHNSON,
Clerk County Court.

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SEALED PROPOSALS will be opened by the Lighthouse Inspector, New Orleans, La., at 2 o'clock p.m., July 25, 1916, for building wharf, walks and foundations under privies at Southwest Pass Light Station, La. Information upon application to above office.

Classified Advertising

Positions Open — Civil Service Work
Positions Wanted
Wanted — Agents and Salesmen, Contract Work
Employment Agencies — Labor Bureaus
For Sale
Miscellaneous — Educational, Books
Business Opportunities
Proposals

ANSWERS addressed to us at 10th Ave. and 36th St., New York or 1144 Monadnock Block, Chicago will be forwarded without charge (excepting circulars or similar literature.)

RATES: Positions Wanted, 3 cents a word, minimum charge 50 cents an insertion, payable in advance. Other advertisements, 5 cents a word, minimum charge $1.00. Count 4 words for blind address care of our New York or Chicago offices. Advertisements for bids $2.40 an inch.

IMPORTANT: Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies. Advertisers' names will not be furnished under any circumstances. Copy received until 10 A.M. Wednesday for following day's issue.

Positions Open

OPENHEARTH AND ROLLING MILL DRAFTSMEN. Apply by letter, giving full particulars. Jones & Laughlin Steel Co., Pittsburgh, Penn.

OPERATOR wanted at once capable of setting up Gridley automatic single- and multi-spindle screw machines. Address, giving full particulars regarding experience, P37—Eng. News.

STRUCTURAL DETAILER wanted for structural shop in Havana, Cuba; must be fully experienced, rapid and accurate on mill building work; state experience, references and salary at once; good position for right man. Address American Steel Company of Cuba, Box 654, Havana, Cuba.

SEWER FOREMAN with gang of men wanted; must be capable of taking charge of deep trench work in both rock and soft ground excavation; long job; none but a live wire need apply; send references and state wages expected in first letter. P36—Eng. News.

EFFICIENCY MAN with technical training for building and maintenance department of a shoe factory in Maine, with experience enabling him to take charge of all new construction and repairs to plant and equipment, maintaining janitor and elevator service, heating, lighting, power, installing, transporting and maintaining all machinery. P32—Eng. News.

EXPERIENCED STRUCTURAL FOREMAN for detailing and checking shop drawings for steel frame office buildings; state age, experience, nationality, salary expected and how soon available. Barber & Ross, Washington, D. C.

A NUMBER OF EXPERIENCED DETAILERS for office building work wanted at once; give experience in full; also salary expected. Address Engineer, 159 Beecher Ave., Detroit, Mich.

MECHANICAL AND STRUCTURAL DRAFTSMEN on variety of work; give experience, reference, age and salary expected; technical men preferred; good opportunity for right men; location Bethlehem, Penn. P61—Eng. News.

AN EXPERIENCED DESIGNER AND DRAFTSMAN wanted on reinforced-concrete structure; give references, age, salary expected, training and experience. P63—Eng. News.

CHIEF ENGINEER wanted by structural steel company in Detroit, to take care of drafting room employing 20 men; must be thoroughly experienced in all branches of the business and capable of assuming executive duties; reply in detail, stating age, experience and salary expected. P68—Eng. News.

EXPERIENCED CHECKERS AND DRAFTSMEN wanted on structural steel work for buildings. Apply by mail only, giving age, education, experience and salary expected. In answering, state full particulars, with special reference to work previously done. Peck Bros., consulting engineers, Scranton Life Bldg., Scranton, Penn.

STRUCTURAL DETAILERS AND CHECKERS wanted; steady positions for competent men. Kellogg Structural Steel Co., 31 Stone St., Buffalo, N. Y.

DRAFTSMEN AND ENGINEERS experienced in gasholder and gas works design and detail and in general mechanical work; men with good technical education preferred; good pay; permanent work. Write or apply Riter-Conley Co., Leetsdale, Penn.

ENGINEER wanted by prominent building construction company in Philadelphia; an engineer who has had thorough experience in designing and estimating reinforced-concrete building construction; steady position for first-class man. P75—Eng. News.

RESIDENT ENGINEER; salary $100, and transitman, salary $75; give full and complete detail of experience. P62—Eng. News.

Employment Agencies

The Agencies advertising here agree to refund any registration fee on demand any time within the first six months when no position is secured.

H. H. HARRISON & CO., Association Bldg., Chicago, registers high-grade manufacturing executives, technical, semi-technical and commercial men. Forward complete data of requirements for immediate attention.

PROFESSORS, instructors and teachers of technical and scientific subjects wanted for schools and colleges all over the United States. H. H. Harrison & Co., Association Building, Chicago.

THE ENGINEERING AGENCY, INC., established 24 years, makes a specialty of furnishing information regarding all kinds of engineering and technical positions. Many of the best positions are filled quickly, therefore never advertised. We particularly need at once: Structural estimator and designer, $150; architectural engineer, $150; draftsman and field engineer experienced in paper mill design, $125; structural detailers, $100; railroad and map draftsmen, $75-100; drainage engineer, must be graduate with five years' experience, $110 and field expenses. Address 1662 Monadnock Building, Chicago, Ill.

LABOR BUREAUS

SPECIAL ADVANTAGES to contractors or others employing laborers, carpenters, mechanics, drill runners, foremen, etc. Commissary privileges optional. Central Labor Agency, 139 Mulberry St., New York. (Tel. Canal 8970.)

EMPIRE LABOR AGENCY, 93 Mulberry St. (Tel. 1745 Franklin), New York. Laborers furnished for all kinds of construction works, free of any fee, provided transportation is advanced.

Correspondent

THE UNDERSIGNED plans and conducts correspondence for positions in technical, manufacturing and professional lines for $2,500 to $15,000 men exclusively. Complete privacy assured. No commission charged—only service fee and postage. Send name and address only, in confidence, for prefatory details. R. W. Bixby (Established 1910), T1 Niagara Square, Buffalo, N. Y.

Positions Wanted

Mechanical and Electrical Engineers

MECHANICAL ENGINEER, 35, technical school and 12 years' broad experience; New York interview. PW78—Eng. News.

Civil Engineers

EXPERIENCED ENGINEER (M. Am. Soc. C. E.), trained in general railroad work, some years in private practice, held important positions in corporation and state service, desires engagement. PW826—Eng. News.

MANAGER OR CHIEF ENGINEER—High-grade engineer and executive, now employed as manager and chief engineer of construction company, desires change; graduate civil engineer, Mem. A. S. C. E.; present salary $3,000; 38 years of age; large, strong and healthy; no bad habits, PW903—Eng. News.

GRADUATE CIVIL ENGINEER, 15 years' experience, designing, estimating, supervising reinforced concrete, steel, general construction and architectural work for industrial plants and railroad structures, open for engagement; speaks also Spanish, French, German. PW10—Eng. News.

ENGINEER (M. Am. Soc. C. E.), many years' experience on construction of railroads, river and harbor works, canals, dams, wharves, terminals, highways and concrete bridges, also management of railroads, machine shops, shipyards and design of dredges, boats and vessels, is open for engagement July 1. PW27—Eng. News.

CONTRACTOR'S ENGINEER-SUPERINTENDENT, 32, Assoc. M. Am. Soc. C. E., 12 years' railroad, concrete bridges, arches, sewers, disposal plants, pile driving, difficult excavations; good organizer; salary $200; Philadelphia or New York interview. PW26—Eng. News.

ASSOCIATE PROFESSOR, civil and hydraulic engineering, C. E. degree, 33, 12 years' university teaching and general practice, desires move to West. PW38—Eng. News, Chicago.

ENGINEERING GRADUATE, construction superintendent, engaged in contracting business for self, wants position with construction company. PW40, Eng. News.

ENGINEER, superintendent, Assoc. M. Am. Soc. C. E., Twelve years' broad experience construction locks, dams, etc., mining, surveys and office. PW41—Eng. News.

CONSULTING ENGINEER REQUIRING ASSISTANT—American, 27 years, graduate civil engineer; experience steel and concrete design; capable taking entire charge in your absence. PW50—Eng. News.

CIVIL ENGINEER, Hungarian, graduate, single, wants steady position; seven years' experience, European, in concrete, railroad, surveys; speaks English, German, French; moderate salary. Chato, "Miners' Journal," 136 E. 17th St., New York City.

CIVIL ENGINEER, U. of P. graduate 1915, age 25, desires change of position; varied experience totaling over 3 years; any line, any place. PW81—Eng. News.

CIVIL ENGINEER, 24, technical graduate, wants position with engineering or contracting company; 2½ years' experience on municipal work and concrete dock construction; presently employed; best references. PW86—Eng. News.

CIVIL ENGINEER, Columbia University, experience in building line, desires position with engineer or contractor leading to advancement. PW66—Eng. News.

A GRADUATE CIVIL AND MECHANICAL ENGINEER with extended executive experience in this country, Mexico and South America, speaking several languages, is open for engagement and will go to any part of the world; experienced in steel design and erection, municipal work, hydro-electric developments, street railway and heavy railroad construction; salary considered, $5,000 per year. PW64—Eng. News.

CIVIL ENGINEER, 31, Assoc. M. Am. Soc. C. E., nine years' experience, at present employed, desires position with consulting or sanitary engineer or on municipal work. PW88—Eng. News, Chicago.

Bridge and Structural

BRIDGE AND STRUCTURAL ENGINEER desires change; 29; technical graduate; seven years' experience estimating designing, checking and in charge of work on steel and concrete railway structures; familiar with construction methods. PW89—Eng. News, Chicago.

Surveyors

HIGH SCHOOL GRADUATE, good mathematician, desires position with surveyor in Ohio. PW90—Eng.News, Chicago.

Draftsmen

CHIEF DRAFTSMAN—American, 27 years, graduate civil engineer, experience steel and concrete design; familiar all types building construction. PW51—Eng. News.

DRAFTSMAN, several years' general engineering experience, open for a position; location New York. PW91—Eng. News.

YOUNG MAN having three years of civil engineering course wishes position as draftsman or surveyor; will go anywhere. PW82—Eng. News.

LADY desires position as draftsman in engineer's office; salary moderate; location anywhere. PW74—Eng. News, Chicago.

Superintendents

SUPERINTENDENT of construction; first-class executive, broad experience; difficult foundations, locks, dams, bridges, building and industrial plant construction; concrete a specialty. PW870—Eng. News.

ASSISTANT SUPERINTENDENT or similar opening; 32 years old; hard, aggressive worker, with initiative; can handle men; Assoc. Member A. S. M. E.; 30 days without salary if not mutually satisfied. Wm. E. Clark, Oshkosh, Wis.

CONSTRUCTION SUPERINTENDENT and engineer with contracting or industrial company; heavy construction and buildings. PW45—Eng. News.

SUPERINTENDENT OF BUILDING CONSTRUCTION, 12 years' practical experience in building hotels, office buildings, power houses, manufacturing plants, high schools; can handle any size of job from start to finish; good organizer and up to date in handling men. PW69—Eng. News, Chicago.

GENERAL FOREMAN OR SUPERINTENDENT, wide experience in handling work for a contractor; practical experience in building work, hotels, office buildings, warehouses, manufacturing plants, schools, from laying out of foundations, placing of concrete, erecting of steel; wideawake and up to date in handling large force of men. PW70—Eng. News, Chicago.

ENGINEER, superintendent of construction, desirous of effecting change; at present engineer of specifications and materials and designing engineer with large manufacturing corporation; executive experience in connection with field and office in the major types of construction; 12 years' experience in estimating, designing and construction. PW87—Eng. News.

TRAVELING SUPERINTENDENT construction of hydro-electric and power pumping machinery desires change to position of maintenance and repair superintendent or other responsible work with concern offering a minimum amount of travel and not less than $2,400 salary; would consider construction work of at least one year's resident to the job; with present employers 20 years and object of change is to avoid continuous travel; location immaterial and services available after reasonable notice. PW77—Eng. News.

SUPERINTENDENT or foreman carpenter for reinforced concrete and general building construction is open for engagement. PW85—Eng. News.

SUPERINTENDENT; 20 years' experience as foreman carpenter and superintendent on various types of buildings, such as frame dwellings to the latest type of fireproof construction, heavy mill construction, concrete work in all its branches, bridge, trestle work and grading; thoroughly competent to handle and lay out the above-mentioned with results; in or out of town; age 42, married. PW83—Eng. News.

Miscellaneous

PROFESSOR OF CIVIL OR STRUCTURAL ENGINEERING, M. Am. Soc. C. E.; seven years' university teaching; 10 years' broad practical experience; C. E. degree; at present manager for construction and bridge company; desires to enter teaching field again. PW821—Eng. News.

TRACK ENGINEER, 30, wants work as instrumentman, draftsman, estimator or assistant; some executive and legal experience and steel and concrete design. Harris, P. O. Box 31, Elkton, Md.

A LIVE-WIRE CONCRETE FOREMAN desires position. Box 64, Chester, Penn.

DIVER, 16 years' experience on concrete construction, stone masonry, submerged pipes for water, gas and sewage, desires engagement with own diving outfit or contractor's outfit; highest references. PW44—Eng. News.

YOUNG MAN, two years' college, 5 years' municipal experience in charge of brick, wood block and concrete pavements, sewers and concrete bridge. PW92—Eng. News.

FIELD, OFFICE MAN, 29, eight years' training in earth and rock excavation, concrete and similar lines, at present employed, desires change; salary $1,500 per year. PW76—Eng. News.

BUILDING CONSTRUCTION—Engineer with lifelong experience with builders and architects in the erection of buildings is open for engagement; nine years as New York manager with last employer. PW72—Eng. News.

ESTIMATOR, technical graduate, 12 years' experience in subcontractor and builder's office, desires position with general contractor in vicinity of New York City. Address "Energetic," PW84—Eng. News.

Wanted

ENGINEERS—mechanical, civil, electrical—well equipped and established engineering office in New York City will assist you to increase your income. You get the work; we do it. W48—Eng. News.

STRUCTURAL DRAFTSMAN wishes extra work for evenings. W80—Eng. News

Agents and Salesmen

PURCHASING AGENT, 12 years' experience contractors', mill, marine and railroad supplies; specialist in cost accounting and office management; broad experience upon inspection work and detailing operation; credentials the best; would also consider selling proposition, supplies or machinery. W65—Eng. News.

SALES ENGINEER for Shanghai wanted; a capable engineer and salesman for well-known line of concrete reinforcement; high-grade man required; good opportunity, good salary; three-year contract. W71—Eng. News.

A LIVE SALESMAN wanted to sell yellow pine in Northern New Jersey (Paterson, Passaic, Newark, etc.); must be a live wire and be able to produce results; need not necessarily have been in the lumber business, but must have a personal acquaintance among the building and construction trade; an automobile will be furnished for transportatton and a good salary and a permanent position is offered to the right man; all replies will be held strictly confidential. W79—Eng. News.

Educational

Structural Drafting—A new correspondence course of instruction and work leading up to actual (paid) experience.

Structural Steel Designing—A complete course of instruction and work reproducing all the conditions of actual experience. By mail only.

Reinforced Concrete Engineering—In its fourth year of successful operation. This course has established a reputation among engineers that is not equalled by any similar correspondence course on this subject. M470—Eng. News.

Business Opportunities

WATER POWER for sale, 500 hp., combined with an established business over 30 years; a going concern with best reputation; no labor trouble. Address Langdon C. Foster, Fulton, N. Y.

For Sale

"ENGINEERING NEWS," years 1913 to 1915 inclusive, copies Apr. 10 and 17, 1913, July 2, 1914, July 15, 1915, Mar. 9 and Apr. 6, 1916. FS67—Eng. News.

"ENGINEERING NEWS," Vol. 59 to 71 inclusive, 62 to 68 bound; good condition; best offer accepted. FS73—Eng. News.

For Sale—Second Hand Equipment

Rates: Less than 4 insertions, 40 cents per line; 4 to 11, 35 cents; 12 or more, 30 cents.

ADVERTISERS' NAMES are abbreviated in most of these items. Complete names and addresses are as follows:

BRADEN, J. S., 26 Cortlandt St., N. Y

CONTRACTORS' Service Co., 50 Church St., N. Y. City.

DALLETT & CO., Harrison Bldg., Philadelphia, Pa.

GIVIN Co., Herbert, 30 Church St., N. Y. City.

HESCO—Hoisting Engine Sales Co., Grand Central Sta., N. Y. City.

LINES FLYNN Co., Inc., 30 Church St., N. Y. City.

MARINE Metal & Supply Co., 167 South St., N. Y. City.

PFAFF & Kendall, Ferry and Foundry Sts., Newark, N. J.

PIPE & Contractors Supply Co., 3 Dover St., N. Y. City.

SAMPSON Co., Geo. H., 13 Pearl St., Boston, Mass., and 32 Bway., N. Y. C.; or Winston & Co., Brown Station, N. Y.

SEYFERT'S Sons, Inc., L. F., 437 N. 3rd St., Philadelphia, Pa.

SOUTHERN Iron & Equipment Co., Grant Bldg., Atlanta, Ga.

STALLEY, G. T., Box 390, Cleveland.

TITAN Equipment Co., 30 Church St., N. Y. City. (Cort. 1111.)

ZELNICKER Supply Co., Walter A., General Office—St. Louis, Mo. Branches—423 First Natl. Bank Bldg., Chicago, Ill., and 910 Hennen Bldg., New Orleans, La.

Air Compressors

2—Ingersoll-Rand cross compound, steam and air cylinders, with Corliss valve gear, 2,500 cu.ft. cap.—SAMPSON.

2—Ingersoll-Rand cross compound, steam and air cylinders, with Corliss valve gear, 3,300 cu.ft. capacity. Boilers and condensers with this plant. All in good condition. Bargain.—SAMPSON.

Several second-hand, steam and belt driven, straight line and two stage of various sizes from 70 to 1,300 cu.ft. capacities. Good condition.—SAMPSON.

1 Rand Class "C" 98 cu.ft. straight line steam driven.—SAMPSON.

2 straight-line (steam driven). American 10x10x10, cap. 236 cu.ft.; Clayton duplex 8x8x7, cap. 150 cu.ft.—MARINE.

2—90 cu.ft. gasoline portable.—LINES FLYNN.

Ingersoll-Rand AA2, straight line, 2-stage, 1,110'.—GIVIN.

Asphalt Plant

For sale—Cummer asphalt plant, 1,200 yards capacity; also Buffalo 8-ton roller, practically new; bargain price; immediate delivery.—W. L. FOX, 68 William St., New York City.

Boilers

35, 50, 60 and 80 H.P. loco.—PIPE.

4—125 hp. and 2—150 hp. hor. ret. tub., butt strapped, triple riveted.—MARINE.

3—500-hp. Sterling water tube.—O. R. WHITNEY, 39 Cortlandt St., N. Y. City.

30-hp., c.-i. base, 110 lb. steam.—HESCO.

1—100-hp. loco. grates, stack.—GIVIN.

Bridges

Highway drawbridge for sale, for delivery in spring of 1916. Through span 176' swing bridge, center support, 20' clear roadway, with one 4' sidewalk; steel trusses and floor beams with wooden stringers and floor plank; designed to carry one 40-ton car on one span; electric operation; built in spring of 1915. For further information apply to Holbrook, Cabot & Rollins Corpn., 6 Beacon St., Boston, Mass.

Buckets

1 yd. Theo. Smith orange peel.—PIPE.

5—¾ yd. std. clam shells.—STALLEY.

Smith, 1; Union Iron Works ¾ yd. clam shells; 10 Steubner 1¼ Excelsior bottom dump concrete.—MARINE.

Hayward ¾-yd., 3-leaf orange peel, A1; Hayward ⅜-yd. standard orange peel, A1; 6 Lockwood automatic dump; 23 Steubner bottom dump.—GIVIN.

Cars

[Standard Gage]

6—6-yd. dump cars, $500.—F. C. ECKMANN, Joliet, Ill.

[Narrow Gage]

40—4-yd., sale or rent—CONTRACTORS S. CO.

[24" Gage]

22 Koppel, 36' capacity.—GIVIN.

Crushers

1 Climax 10x20 portable, complete; 1 No. 6 Gates K manganese fitted; 1 No. 7½ McCully, manganese fitted; 1 No. 8 Kennedy, manganese fitted.—GIVIN.

Derricks

Steel stiff leg, 125' boom, bull wheel, 35 ton.—TITAN.

Drag Line Machines

1—1-yd. Monighan, steel frame and steel boom.—ZELNICKER.

Engines, Gas and Oil

One 8 H.P. vertical type Fairbanks with sub-base.—SAMPSON.

Excavators

For all classes of work.—TITAN.

Generators

Western Electric 100 K.W. dir. con. to 14x14 engine, 240 volts.—MARINE.

Hoisting Engines

2—3 drum Nationals, one 10x12 and one 8¼x10, with boilers; Lambert 8½x10 D.D. D.C. skeleton; 7½x10 D.D. D.C. skeleton; 15 other makes and sizes.—MARINE.

12 Lidgerwoods and other makes, hoisting engines and cableways, skeleton and with boilers.—PIPE.

All sizes, sale or rent.—HESCO.

8—8¼"x10" D.C. D.D. with boilers, American, cheap before removal.—SEYFERT'S.

2—6½x10 National D.D. boiler; 8½x12" Flory 3-drum boiler, Dake swinger.—GIVIN.

Hoists

1 skip hoist and bucket in good condition, made by Insley Mfg. Co.; capacity 12 cu.ft.—JACOB E. DECKER & SONS, Mason City, Iowa.

Hoists, Electric

25-hp. D.D. National.—HESCO.

Instruments, Surveying

Second-Hand Transits, Levels, etc. Bought, sold and exchanged. Send for list.—WILLIAMS, BROWN & EARLE, Inc., Engineering Supplies, Dept. E, 918 Chestnut St., Phila.

Used transits and levels.—W. J. BUFF, 50 Church St., New York City.

Transits and levels sold and rented.—The Engineering Agency, Inc., Monadnock Block, Chicago.

Locomotives

[Standard Gage]

50 Switch, Mogul, Consolidation, ten wheel & saddle tank types.—SOUTHERN.

Narrow & standard gage.—SOUTHERN.

35-ton Climax geared, overhauled from rails up; like new.—DALLETT.

[Narrow Gage]

10x16 Porter, sale or rent.—CONTRACTORS S. CO.

[36" Gage]

10x16 Baldwin, sale or rent.—BRADEN.

8—10x16" Porter, Davenport and Vulcans; 5—9x14" Porters.—SOUTHERN.

[24" Gage]

1—3½-ton Bell, oil burning; 1—6-ton Porter, saddle tank.—GIVIN.

Locomotive Cranes

4—8-wheel; 10, 15, 20-ton cap.—Hoisting Machinery Co., 48 Church St., N. Y. C.

15-ton, A1 condition, cheap.—STALLEY.

1—15 ton 4-wheel Browning.—GIVIN.

4 or 8-wheel, 5 to 40-ton cap.—TITAN.

4—8-wheel, 10-20 tons.—CONTRACTORS S. CO.

15-ton 8-wheel Brown hoist; 10-ton 4-wheel McMyler, both with bucket; 17-ton 4-wheel Industrial. All standard gage.—DALLETT.

Mixers

(Asphalt and Concrete)

Hadsel 2 yd. Batch with engine; Ransome ¾ yd. with engine and hopper; Foote continuous No. 2½, 7½ H.P. motor, D.C., on wheels.—MARINE.

Portable plant, complete, capacity 300-600 yd. per day; rare bargain.—LINES FLYNN.

1 Eureka, continuous, 3 HP., D.C. motor; 1—2½ Smith and one ¾-yd. Ransome with engine on skids.—PIPE.

½ yd. SSS gas., sale or rent.—HESCO.

Piling, Sheet Steel

100 pcs. 10 ft. U.S. 12½"; 180 pcs. 13 ft. Wemlinger 12"; 340 pcs. 16 ft. Wemlinger 12"; 115 pcs. 18 ft. Wemlinger 12"; 450 pcs. 18 ft. Lackawanna 12¾"; 300 pcs. 20 ft. U.S. 12"; 240 pcs. 20 ft. Wemlinger 12"; 175 pcs. 21 ft. Lackawanna 12¾"; 115 pcs. 22 ft. Wemlinger 12"; 70 pcs. 22 ft. Lacka. arched web 14"; 140 pcs. 40 ft. Lacka. arched web 14". Thousands of tons of other sizes. We specialize. Don't buy before consulting ZELNICKER.

57 pcs. ⅜"x14" arched Lackawanna, weight per foot 40.83 lb., lengths 9' to 30'.—Box 57, Potsdam, N. Y.

Pipe and Fittings

Wrought pipe, guaranteed, sizes ¾" to 20".—PIPE.

300,000 rethreaded, wrought, sizes ¾" to 24".—MARINE.

All sizes, Second-hand pipe or new mill seconds. Big stock. Prompt shipment.—Eagle Pipe Supply Co., 30 Church St., N.Y.

Pipe and fittings, with new threads and couplings; cut to lengths.—PFAFF.

Pumps

1 Cameron 3½x2x4 steam.—SAMPSON.

A 10-in. belt-driven Swaby steam sand pump for sale; never been used.—ABSECON SAND CO., 1515 Arch St., Phila., Pa.

Rails

700 tons of steel rails in 30' lengths, 60 and 70 lb., together with frogs, switches and fastenings, located at Mechanicville and Baldwinsville, N. Y.—James Stewart & Co., Inc., 30 Church St., N. Y. City.

15,000' portable track 24" gage.—GIVIN.

10 miles 16's practically new, 20 miles 20's choice relays, 10 miles 25's choice relays, 5 miles 30's practically new. Can furnish almost all wghts.—ZELNICKER.

Road Rollers

10-ton Iroquois 3-wheel macadam.—SEYFERT'S.

1 gas macadam roller, little used, low price. Write FS710—Eng. News.

Sewer Plants

Contractors plant comprising air compressors, mixers, cableways, pumps, cars, hoists, buckets.—LINES FLYNN.

Steam Shovels

32-ton revolving std. gage; 70-ton rebuilt Bucyrus.—LINES FLYNN.

SALE OF BRADLEY EQUIPMENT
BIG SAVINGS RIGHT DOWN THE LINE

AIR COMPRESSORS

Item

1 Ingersoll-Rand Class P. R. Compound Direct Electric-Driven Air Compressor, synchronous type motor, size 25½x15½x21, 100-lb. pressure, intercooling, having brass tubes, capacity 2100 cu.ft. per min., shop Nos. 15716 and 15717.

1 General Electric Type Motor, No. 414735, P. F. I., type ATI, Class 16, 282M, 187.5, form E, hp. 350, speed 187.5, volts 6600, amp. 24.7, cycles 25.

1 Exciter General Electric Co. Continuous Current Generator, compound-wound, 352402, type CVC-115, form A1020, speed 975, kw. 9½, volts 125, amp. 76.

1 Switchboard Panel No. 98346, type ATY, 350 hp., volts 6600, amp. 29.5, 2 amp. meters, 2 oil switches, 2 time relays, 1 discharge rheostat, 1 starting compensator, 2 transformers.
Special panel board of slate with Time Clock Pressure gauge and Bristol recording gauge.

2 Ingersoll-Rand Class P. R. 2 Compound Direct Electric-Driven Air Compressor, synchronous type motor, size 25½x15½x21, 100-lb. pressure, intercooler having brass tubes, capacity 2100 cu.ft. per min., shop Nos. 15714 and 15715.

2 General Electric Type Motor, No. 414734, P. F. I. Type ATI, Class 16, 282M, 187.5, Form E, hp. 350, speed 187.5, volts 6600, amp. 24.7, cycles 25.

2 Exciter General Electric Co., continuous current generator compound-wound, 352285, type CVC-115, form A1020, speed 975, kw. 9½, volts 125, amp. 76.

2 Switchboard Panel No. 98347, type ATY, 350 hp., volts 6600, amp. 29.5, 2 amp. meters, 2 oil switches, 2 time relays, 1 discharge rheostat, 1 starting compensator, 2 transformers.

3 Ingersoll-Rand Class P. R. No. 2 Compound Direct Electric-Driven Air Compressor, synchronous type motor, size 25½x15½x21, 100-lb. pressure, intercooler having brass tubes, capacity 2100 cubic feet per minute, shop Nos. 16276 and 16277.

3 General Electric Type Motor, No. 414737, P. F. I., type ATI, class 16, 282M, 187.5, form E, hp. 350, speed 187.5, volts 6600, amp. 24.7, cycles 25.

3 Exciter General Electric Co. Continuous Current Generator, compound-wound, No. 352268, type CVC-115, form A1020, speed 975, kw. 9½, volts 125, amp. 76.

3 Switchboard Panel No. 101593, type ATY, 350 hp., volts 6600, amp. 29.5, 2 amp. meters, 2 oil switches, 2 time relays, 1 discharge rheostat, 1 starting compensator, 2 transformers.

4 Ingersoll-Rand Class P. R. 2 Compound Direct Electric-Driven, synchronous type motor, size 25½x15½x21, 100-lb. pressure, intercooler having brass tubes, capacity 2100 cu.ft. per min., shop Nos. 16440 and 16441.

4 General Electric Type Motor, No. 518239, P. F. I., type ATI, class 16, 282M, 187.5, form E, hp. 350, speed 187.5, volts 6600, amp. 24.7, cycles 25.

4 Exciter General Electric Co. Continuous Current Generator, compound-wound, No. 354793, type CVC-115, form A1020, speed 975, kw. 9½, volts 125, amp. 76.

4 Switchboard Panel No. 101592, type ATY, 350 hp., volts 6600, amp. 29.5, 2 amp. meters, 2 oil switches, 2 time relays, 1 discharge rheostat, 1 starting compensator, 2 transformers.

5 Ingersoll-Rand Class P. R. 2 Compound Direct Electric-Driven Air Compressor, synchronous type motor, size 25½x15½x21, 100-lb. pressure, intercooler having brass tubes, capacity 2100 cu.ft. per min., shop Nos. 15718 and 15719.

5 General Electric Type Motor No. 414736, P. F. I., type ATI, class 16, 282M, 187.5, form E, hp. 350, speed 187.5, volts 6600, amp. 24.7, cycles 25.

Item

5 Exciter General Electric Co. Continuous Current Generator, compound-wound, No. 352404, type CVC-115, form A1020, speed 975, kw. 9½, volts 125, amp. 76.

5 Switchboard Panel No. 98349, type ATY, 350 hp., volts 6600, amp. 29.5, 2 amp. meters, 2 oil switches, 2 time relays, 1 discharge rheostat, 1 starting compensator, 2 transformers.

6 1 Kerosene Air Compressor, No. 2824, on wheels manf. by De La Vergne Refrigerating Co.

8 2 Westcott Proportional Air Meters, 50,000 ft.

STEAM BOILERS

20 1 230-hp. Locomotive Type Boiler, 396 1½ tubes, 11 ft. 8 in. long, grate area 45 and 6/10 sq ft., heating surface 2353 sq.ft., working pressure 100 lb.
P.H.

21 1 200-hp. Algny Water Tube Boiler, working pressure 250 lb. sq.in., grate area 36 8/10 sq. ft., heating surface 1436 sq.ft.
P. H.

22 Beggs Upright Boiler, 9 ft. x 55 in., 60 hp., 7½ sq.ft. grate surface, working pressure 100 lb.
Rad.

23 1 Lambert Upright Boiler, list No. 10603, size 99 x 46, 40 hp.

24 1 Lambert Ravenswood Upright Steam Boiler No. 30821, size 99 x 46, 40 hp.

STEAM SHOVELS

30 1 Model 40 Marion Steam Shovel No. 2266 standard gauge, length of boom 21 ft., length of dipper stick 14 ft., size of bucket 1½ yd., with traction wheels.

STEAM SHOVEL EXTRA PARTS

4 Extra 1½-yd. Rock Buckets.
1 Extra 15 ft. 6-in. Tunnel boom.
1 Extra 8-ft. Dipper Stick.
1 Extra 10-ft. 4-in. Dipper Stick.
1 Extra 12 ft. 9-in. Dipper Stick.
Miscellaneous Parts of Steam Shovels.
Whoever buys shovels will buy extra parts for same.
These extra parts on hand for steam shovels.

31 1 Model 40 Marion Steam Shovel No. 2267, standard gauge, length of boom 21 ft., length of dipper stick, 14 ft., size of bucket 1½ yd.

32 1 Model 20 Marion Steam Shovel No. 1051, standard gauge, length of boom 19 ft., length of dipper stick 11 ft. 6 in., size of bucket 1½ yd.

33 Little Giant Vulcan Steam Shovel No. 1006, standard gauge, length of crane 17 ft. 5 in. length of dipper stick 12 ft., size of bucket 1½ yd.

HAULING LOCOMOTIVES

40 1 5-ton Bell Locomotive, 36-in. gauge, working pressure 250 lb., gasoline

42 1 30-ton Davenport Locomotive No. 1179, standard gauge.

43 1 30-ton Davenport Locomotive No. 1178, standard gauge.

ELECTRIC PUMPS

50 Lawrence 6-in. Electric Centrifugal Vortex Pump No. 2401, suct. 6 in., dis. 6 in. continuous current motor No. 310022, winding shunt DLC 2, Form A, amp. 93, volts 230, speed 950, hp. 25, General Electric.

51 Lawrence 6-in. Electric Centrifugal Vortex Pump No. 2475, motor No. 100449, size 201, type CM 26 hp., A. T. 1025 r.p.m., 230 volts, 95 amp., Crocker Wheeler Co.

52 6-in. Electric Centrifugal Vortex Pump No. 2656, suct. 6 in., dis. 6 in., continuous current motor No. 318370, winding shunt, DLC 25, Form A amp. 93, volts 230, speed 750, hp. 25.

53 Lawrence 6-in. Electric Vortex Pump No. 8492, Size 6 DLC Type DM, continuous current motor 366974, winding shunt DLC 202, Form A, amp. 93, volts 230, speed 950, hp. 25, General Electric.

54 Lawrence Electric Centrifugal Pump No. 8465, size 4188S, type DM, motor No. 375822, type DVC-114, wound No. 375,822, speed 1250, hp. 10, volts 230, amp. 37.7, General Electric.

Item

55 Lawrence 8-in. Electric Vortex Pump No. 2580, continuous current motor No. 310234, winding shunt DLC 35, form A, amp. 129, volts 230, speed 700, hp. 35, General Electric.

56 Lawrence 6-in. Electric Vortex Pump No. 2436, continuous current motor 318302, winding shunt DLC-2, form A, amp. 93, volts 230, speed 950, hp. 25, General Electric.

57 Electric Centrifugal Pump 8408, size 4188S, continuous current motor 351407, shunt wound 351407, type CVC-114, form A11 speed 1250, volts 230, open. hp. 10, amp. 37.7, General Electric.

58 Lawrence 4-in. Electric Centrifugal Pump No. 8409, size 4188S, type DM, suct. 4 in., dis. 4 in., Motor contin ous current, shunt wound, type CVC-114, form A11, speed 1250, amp. 37.7 volts 230, hp. 10, General Electric.

59 Lawrence 6-in. Electric Vortex Centrifugal Pump 8493, continuous current motor 366973, DLC-202, form A, amp. 93, speed 950, hp. 25, General Electric.

60 Lawrence 6-in. Electric Vortex Pump, 2625, continuous current motor 318973, winding compound DLC 25, form A, amp. 93, volts 230, speed 750, hp. 25, General Electric.

61 Lawrence 4-in. Electric Centrifugal Pump 2213, continuous current motor 313888, shunt wound 313888, type CQ-10, form A38, speed 1000, volts 230, open. hp. 15, amp. 55, closed, hp. 7, amp. 26, Gen. Elec.

62 Bush Electric Centrifugal Pump size 2½, automatic electric motor 9457, 5 hp., 220 volts, 1100 speed, type G, Eddy Elec. Mfg. Co.

63 Goulds Electric Triplex Pump 20333, Fig. 957, size 7x8, Crocker Wheeler motor 93210, size 7.51, type CM, 7.5 hp., A. T. 850 r.p.m., 220 volts, 29.6 amp.

64 Goulds Electric Triplex Pump 20334, Fig. 957 size 7x8, belt drive, electric motor 1760, type MP, class A9, 850, form A, amp. 36, volts 250, hp. 10, speed 800, General Electric Co.

65 Edison Twin Diaphragm Gasoline Pump, size 3 in., Fairbanks gasoline engine No. 14504, type 3½.

STEAM PUMPS

80 Cameron Steam Pump No. 43365, size 10A.

81 Cameron Steam Pump No. 37251, sinking pump, size 8, pat. D, suction 4 in., dia. 3½, 10x13x6.

82 Cameron Steam Pump 22156, size 5, suction 3, discharge 3.

83 Cameron Steam Pump 22223, size 3C, suct. 3 in., discharge 2½ in.

84 Cameron Steam Pump 36151, size 5B, suct. 4-in., discharge 3-in.

85 Cameron Steam Pump No. 22191, size 5, suct. 3 in., discharge 2½ in.

86 Cameron Steam Pump No. 4322, size 4, 7x6x8x4

87 Cameron Steam Pump No. 36620, size 5B.

88 Cameron Steam Pump 21877, size 5.

89 Cameron Steam Pump No. 36412, size 4, damaged, no crown head, suct. 2½ in., discharge 2 in

90 Cameron Steam Pump 35924, size 5B.

91 Cameron Steam Pump No. 22532, size 5B.

92 Cameron Steam Pump No. 35921, size 5B, 6x7x13.

93 Cameron Steam Pump, no plate, No. 14822, size 4.

94 Cameron Steam Pump No. 22592, size 5B, 7x10x5.

95 Worthington Steam Pump No. 36884, size C, fire, 10x5x10, 5 in. x 4 in.

96 Dean Duplex Steam Pump, size 6x5½x6, 4 in. x 3 in.

97 Dean Duplex Steam Pump 37501, size 7½x5x6. 4 in. x 3 in.

98 Dean Steam Pump, size 3x2, 2½ in. x 1½ in.

99 Worthington Steam Pump No. 208049, 152x102x 152, 6x4x6, 3 in. x 2 in.

100 Blake Duplex High Pressure Pump No. 103398 x10, size 14x14x10.

101 Blake Steam Pump, size No. 6, 3 in. x 2½ in.

102 Laidlaw-Dunn-Gordon Duplex High-Pressure Plunger Pump No. 17112, size 10x5x10.

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Kindly send me your price list of the equipment for sale as advertised in Engineering News.

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Thew Revolv. No. 0's, 1, A1.—TITAN.
Thew "O," sale or rent.—BRADEN.
Marion Model 60.—SOUTHERN.
Type "O" Thew and 14B Bucyrus, high numbers, fine order.—DALLETT.

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30,000 lb. 5/8"x.051 Bessemer steel bands in long lengths, price for the lot $2.90 per cwt. f.o.b. New York City.—PIDGEON-THOMAS IRON CO., Memphis, Tenn.

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C.-I. tank 4½'x8' round, closed.—Pfaff.

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1 Advance, 12 H.P.—PIPE.

2 Buffalo Pitts 22 HP. traction engines and 4 side dump trailers.—Clifford L. Miller & Co., 110 East 23rd St., N. Y. City.

WANTED

Gasoline locomotive—Plymouth 3-ton, 36" gage.—Morris County Crushed Stone Co., Morristown, N. J.

Macadam roller—One 10-ton at a bargain. Send lowest cash price and description to W711—Eng. News.

Contractors' plants and equipment bought for cash.—Pipe and Contractors Supply Co., 3 Dover St., New York.

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Air Compressors	Electric Locomotives	Pipe
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We have a surplus of 4, 6 and 8-hp.

UPRIGHT BOILERS

100 lb. working pressure, all new, never been used, were purchased before the rise in material. We can make attractive prices.

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Offers will be received by mail for all or any part of the equipment of the R. G. Miller Contracting Company. Equipment consists of everything from shovels and picks to steam rollers. List of the articles may be secured by writing Benedict M. Holden, Trustee, 18 Asylum Street, Hartford, Conn.

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Sealed proposals in lump sum bid will be received up to July 10th, 1916, for the entire plant consisting of the following material, subject to sales prior to June 24th:

Air Compressors: Two Laidlaw-Dunn-Gordon electrically operated, without motors.

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List describing material and terms of sale can be secured from

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1—10x16-in. Baldwin Standard Gauge Saddle Tank Locomotive.
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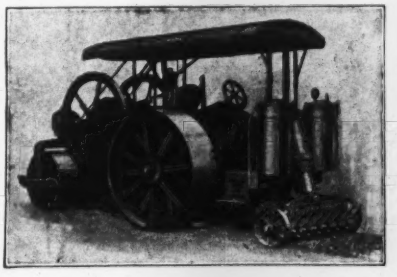

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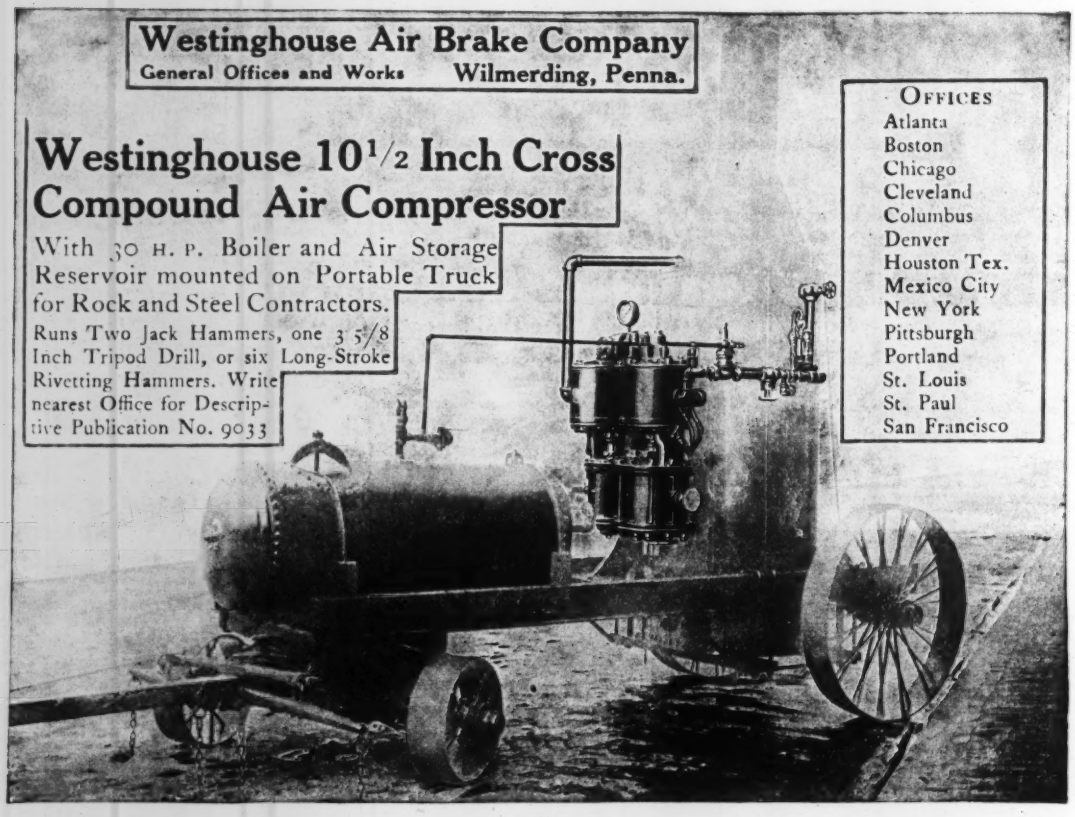
Westinghouse 10½ Inch Cross Compound Air Compressor

With 30 H. P. Boiler and Air Storage Reservoir mounted on Portable Truck for Rock and Steel Contractors.

Runs Two Jack Hammers, one 3 5/8 Inch Tripod Drill, or six Long-Stroke Riveting Hammers. Write nearest Office for Descriptive Publication No. 9033



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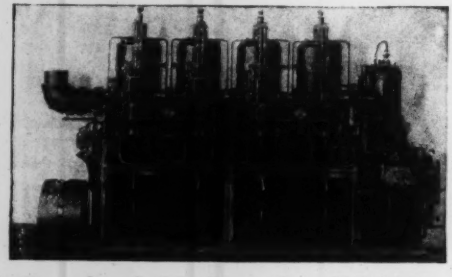

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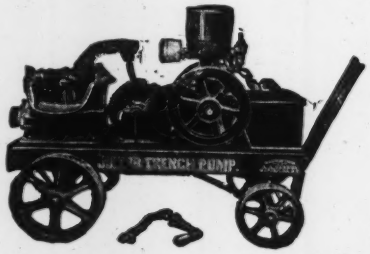

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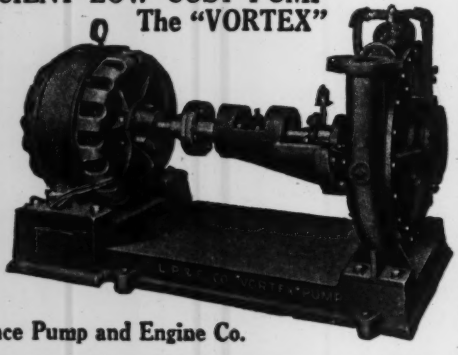
(New England Agents: Perrin Seamans & Co. 57 Oliver St., Boston, Mass.)

AN EFFICIENT LOW COST PUMP
The "VORTEX"

This 3-inch "Vortex" Pump with 15 H. P. Motor has a capacity of 250 gallons per minute and is built for any head up to 125 feet. Bearing surfaces are ample for permanent alignment. Absolutely no end thrust of shaft. No thrust bearings.

Get our Catalog showing the "Vortex" line of pumps



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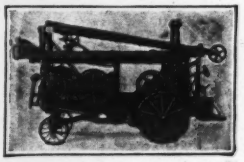
Direct Steam Driven, Belted or Geared from Motor

for Heavy Service in elevating large quantities of water from deep artesian wells. Catalog 6.



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Beaver Falls, Pa.
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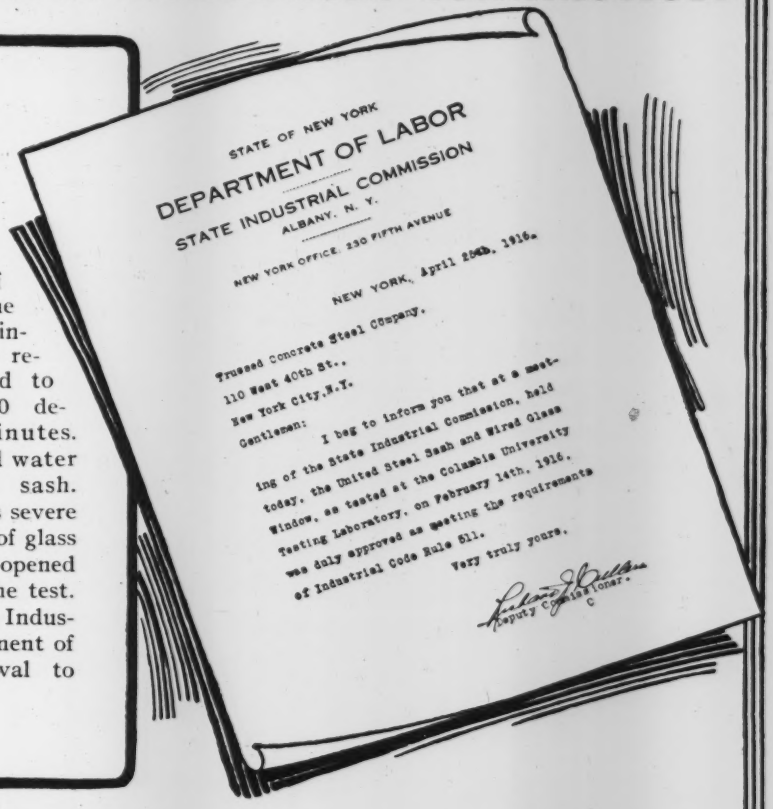
UNITED STEEL SASH tested and approved by New York State Industrial Commission

This remarkable fire and water test on United Steel Sash was conducted at the Columbia University Testing Laboratory by James S. Macgregor, M. S. for the New York State Department of Labor. One entire side of the test house was formed of United Steel Sash. For one hour and twelve minutes (instead of forty-five minutes as required) the sash was subjected to an intense fire reaching 1,600 degrees during the last 15 minutes. Immediately a stream of cold water was directed against the sash. United Steel Sash withstood this severe ordeal perfectly without a pane of glass dropping out. The ventilators opened and closed as easily as before the test. As a result of the test, The State Industrial Commission of the Department of Labor gave its official approval to United Steel Sash



STATE OF NEW YORK
DEPARTMENT OF LABOR
STATE INDUSTRIAL COMMISSION
ALBANY, N. Y.

NEW YORK OFFICE 230 FIFTH AVENUE

NEW YORK, April 25th, 1916.

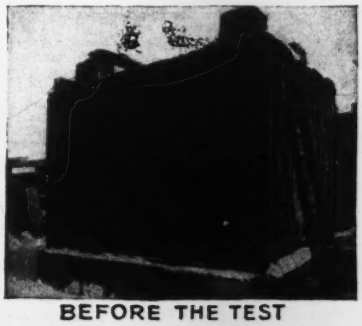
Trussed Concrete Steel Company,
110 West 40th St.,
New York City, N.Y.

Gentlemen:

I beg to inform you that at a meeting of the State Industrial Commission, held today, the United Steel Sash and Wired Glass Window, as tested at the Columbia University Testing Laboratory, on February 14th, 1916, was duly approved as meeting the requirements of Industrial Code Rule 511.

Very truly yours,

Deputy Commissioner.



BEFORE THE TEST

Thus once more United Steel Sash have demonstrated their absolute fireproofness under the most vigorous tests. United Steel Sash are also distinctly superior in weatherproofness, strength, daylighting, construction and workmanship. The complete line of United Steel Sash includes everything in pivoted and sliding sash, continuous sash, partitions, doors, casements, etc.

Large Sash Book sent on request.

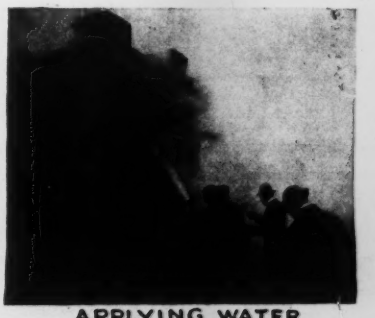
Trussed Concrete Steel Co.

Dept. S-12 - - YOUNGSTOWN, OHIO

Representatives in Principal Cities.

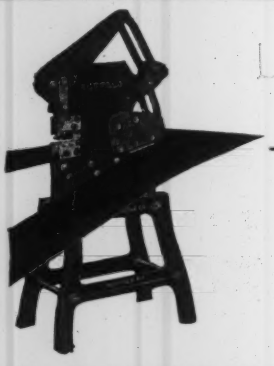
KAHN Building Products

DURING THE TEST



APPLYING WATER

AFTER TEST-VENTS OPEN EASILY



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The Buffalo No. 4½ is a good all-around size and then we have many others.

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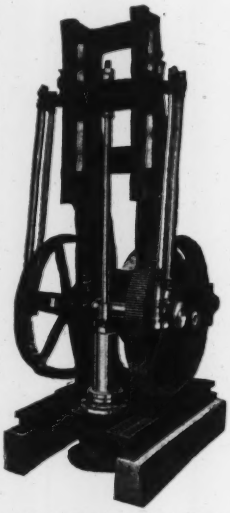

Steam and Power Deep Well Pumps, Single and Double Acting; Cook's Patent Brass Tube Well Strainers; Deep Well Cylinders; Sucker Rods and Well Tools.

Deep Well Pumping Systems installed complete.

Cook Single Acting Deep Well Power Head

Write for Catalog No. 11-G

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Cook Deep Well Products have always been manufactured by A. D. Cook, Lawrenceburg, Ind., The Cook Well Company of St. Louis, Mo., a selling organization, has retired from active business and has transferred its good will and records to A. D. Cook and in the future the customers of the Cook Well Company will receive direct service upon Cook Deep Well Products by writing to A. D. Cook, Lawrenceburg, Ind.

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Our complete line of gas fired furnaces is unsurpassed. Let us tell you more about them. Write.

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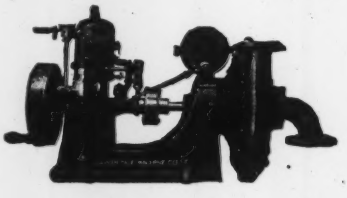

Lawrence Gasoline Engine direct-connected Contractor's Pumps are furnished either double or single suction, in sizes from 2" to 10" discharge. They are meeting with great success.

Positive reliability and extreme ruggedness are noteworthy features. Our engineers will gladly assist you in selecting the best outfit for your needs. **Write.**

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BOILERS in STOCK
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THE STREAM IS CONTINUOUS

The economy of the Nye New Model High Pressure Pump is based upon its unfailing ability to continually discharge a great amount of solids—at a higher elevation than any other pump on the market. Pumps water, sewage, coal, sand, hair and crushed rock or malt. **Send for Catalog No. 14.**

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PUMPING MACHINERY
IN ALL TYPES FOR ALL USES
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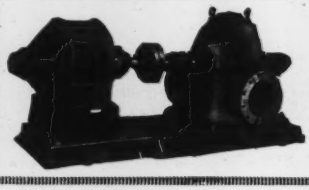

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Belted or direct connected for heads up to about 150 ft. Muit stage for higher heads. Request Catalog "E."

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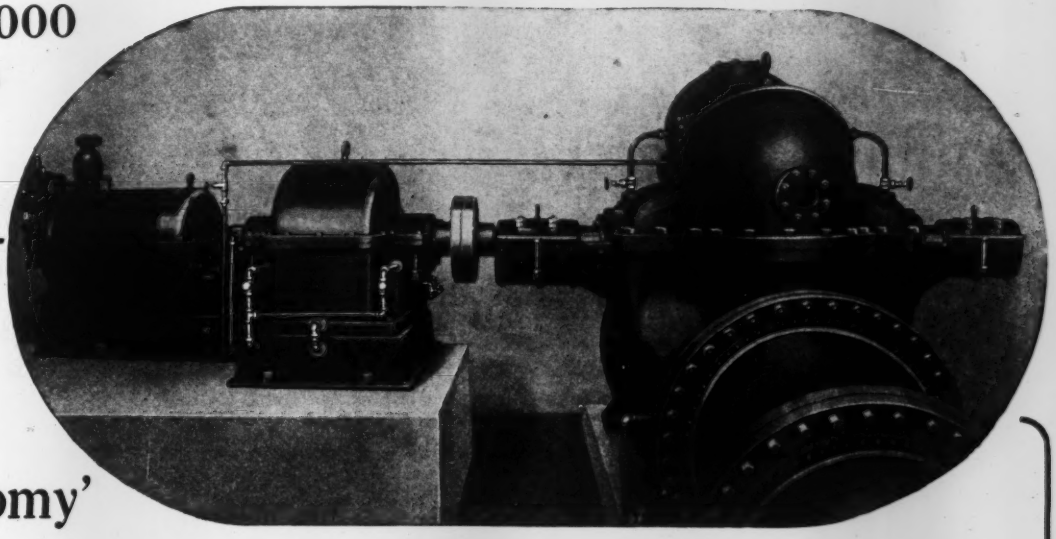
46,000,000 Gallons a Day



'Kerr Economy'

Economical Steam Turbine Drive for Low Head Pumps in Irrigation Work has become an every-day reality through the perfection of the **'Kerr Economy' Steam Turbine** and the **'Kerr Economy' Herringbone Reduction Gear.** Here is shown a 200-hp., 3,600 r.p.m. turbine geared to a pump at 330 r.p.m. having a capacity of 46,000,000 gallons a day against a 17-ft. head.

This unit occupies a floor space of only 19 ft. 9 in. x 6 ft. It was installed for the Rio Grande Canal Co., Brownsville, Texas.

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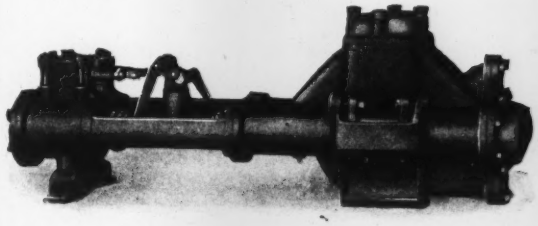

This pump is used extensively for hydraulic jetting purposes, and will throw a large volume of water without slippage against high pressures, and will sink a pile through sand more quickly and more effectively than any other type of pump.

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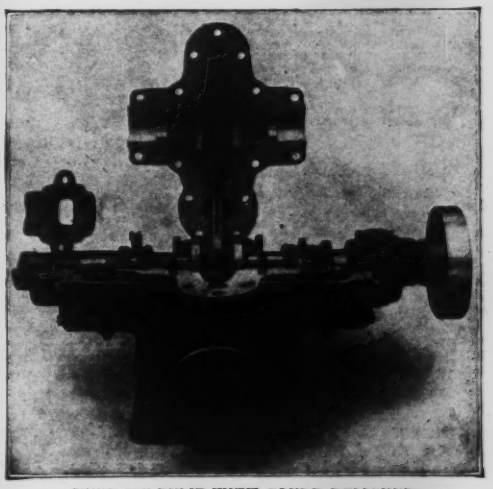

TYPE "S" PUMP WITH COVER REMOVED.

Can usually be shipped from our stock if you will tell us your needs in sufficient detail.

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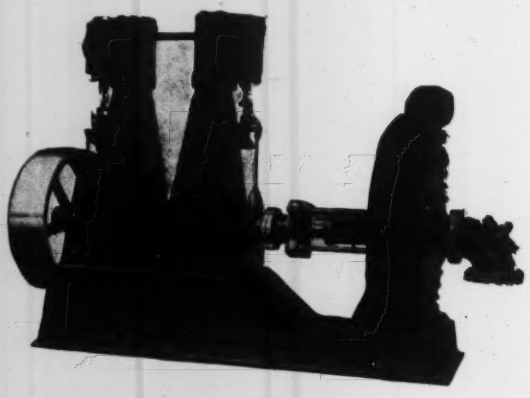
For all Canadian Business refer to Canadian Allis-Chalmers, Ltd., Toronto, Ont., Canada.



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in handling solids in suspension, use

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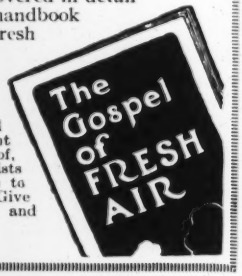
Ventilation Facts

THE subject of ventilation and ventilation problems is covered in detail in our 24-page handbook "The Gospel of Fresh Air." It takes up such subjects as fresh air and labor output, ventilation and workers' errors, the semi-mechanical principle, how to mount ventilators on any roof, exact specifications, lists of users, etc. Free to you on request. Give name of company and writer.



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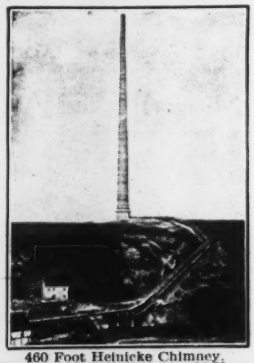

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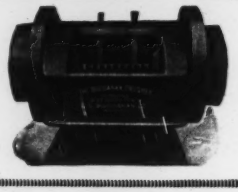

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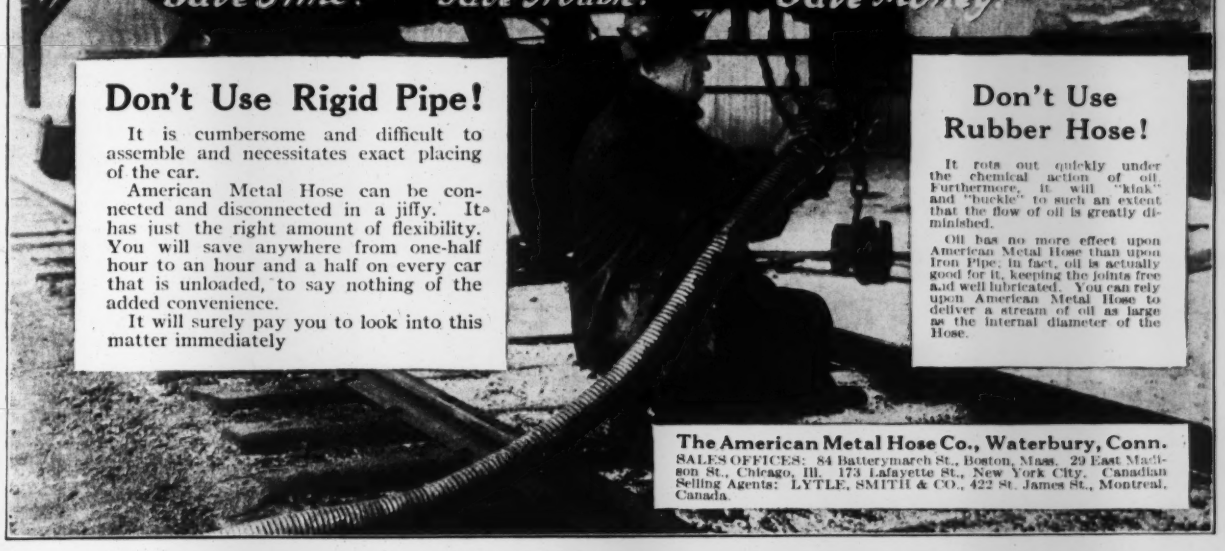

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It is cumbersome and difficult to assemble and necessitates exact placing of the car.

American Metal Hose can be connected and disconnected in a jiffy. It has just the right amount of flexibility. You will save anywhere from one-half hour to an hour and a half on every car that is unloaded, to say nothing of the added convenience.

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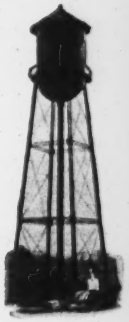

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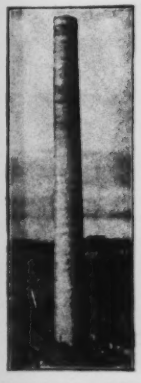

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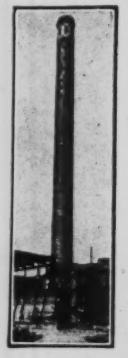

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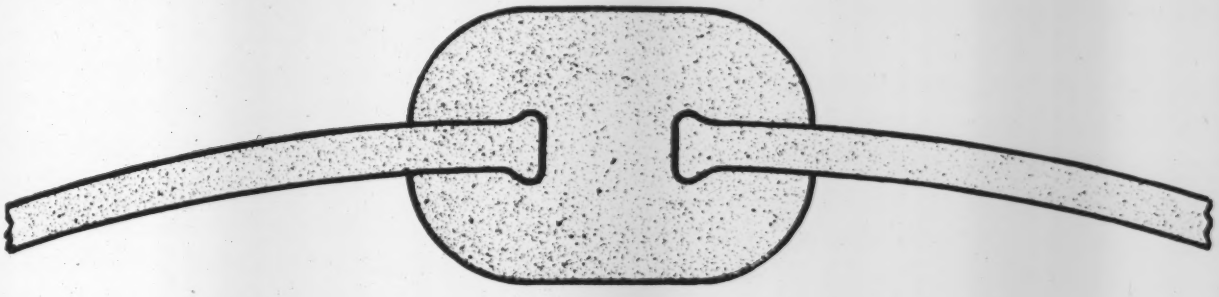

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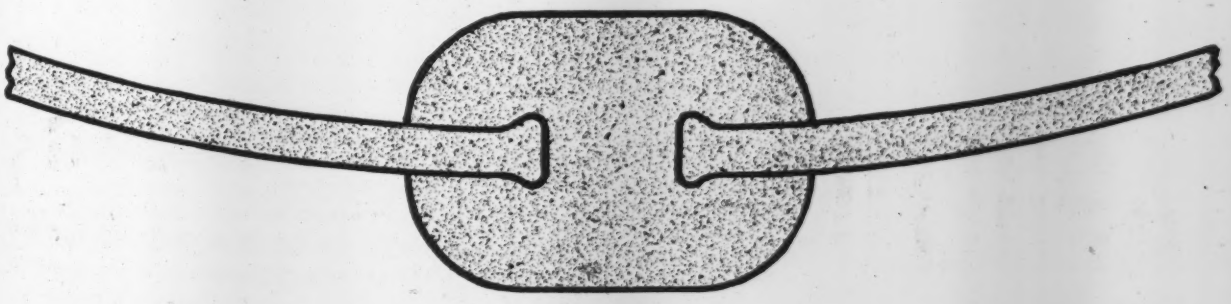

Cast Iron Pipe

Bell and Spigot—Flange

For 58 years we have been manufacturing the highest quality cast iron pipe and special fittings.

Send us your orders. Our large stock, always on hand, guarantees prompt shipment. Write.

Warren Foundry and Machine Co.

Sales Office: 11 Broadway, New York
Works: Phillipsburg, N. J.

Portland is the Perfect Pipe

Made of the finest old growth Oregon or Douglas Fir, Portland Wood Pipe is cheaper than iron or steel pipe yet of greater efficiency.

Portland Wood Pipe Co., Portland Oregon

Piping Facts of interest are contained in the Washington P. & F. Co.'s book. The knowledge of experts has gone into it—men who have a means of solving the piping difficulty that perchance now confronts you.

Today is a good day to send for your copy.

WASHINGTON PIPE & FOUNDRY CO.
1512-1620 Center St. and 3001-3019 Asotin St., TACOMA, WASH.

The following makers of Cast Iron Pipe and Fittings are independent of each other and competitors; inquiries may be sent to any or all of them with assurance of prompt and full service:

James B. Clow & Sons, Chicago, Ill.
Massillon Iron & Steel Co., Massillon, Ohio.
U. S. Cast Iron Pipe & Fdry. Co., Philadelphia, Pa.
American Cast Iron Pipe Co., Birmingham Ala.
Donaldson Iron Co., Emaus, Lehigh Co., Pa.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Lynchburg Foundry Co., Lynchburg, Va.
Standard Cast Iron Pipe & Fdry. Co., Bristol, Pa.

PENNSYLVANIA METAL HOSE

Outwears rubber hose 10 to 1—as flexible but 30% lighter.

Write for booklet.

Pennsylvania Flexible Metallic Tubing Co.
Broad and Race Sts., Philadelphia
New York, Chicago, Boston, Los Angeles, San Francisco, Houston, Seattle

Cut Out the Lost Motion of Nut Turning by using the **FAVORITE** Reversible Ratchet **WRENCH**

A TIME SAVER
See our advertisement in each week.

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Sole Manufacturers
108 Duane St. - New York

Stand Pipe Iron Tanks Blast Furnaces
Self-supporting Stacks and Heavy Plate Work **Pittsburgh, Pa.**

ROOT

Spiral Riveted Pipe—
Pipe Specialists for 48 years.
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Works: Newburgh, N. Y.
N. Y. Office: 45 Broadway

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NATIONAL

The Name

Uses of "NATIONAL" Pipe.

¶ The phenomenal increase in the uses of "NATIONAL" Pipe is one of the romances of the tubular industry.
¶ One of the latest chapters in this wonderful story has this heading—REACHING FOR MORE.
¶ Be sure to read the two pages it covers in the July 6th issue. If you use pipe you will be interested.

NATIONAL TUBE CO., Pittsburgh, Pa.

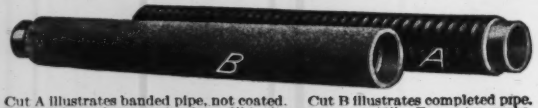
R. D. WOOD & CO.,

Engineers, Iron Founders and Machinists

400 Chestnut Street, Philadelphia

Mathews' Single and Double Valve Gate Valves — FIRE HYDRANTS — Valve Indicator Posts

Manufacturers of All Kinds and Sizes of **CAST-IRON PIPE**



Cut A illustrates banded pipe, not coated. Cut B illustrates completed pipe. We build wood water pipe from 2" in diameter up to 48". For water works, municipalities, coal mines and chemical purposes. Write for our complete catalogue. Best quality—prompt attention—right prices.

Standard Wood Pipe Company, Williamsport, Pa.

THE PENN COUPLER

OUR latest development of the M. B. C. Coupler, a modification of our popular Pitt and Janney "X" Couplers, with latest improvements. "Lock-to-the-Lock," "Lock-Set" and "Knuckle-Opener." Send for blueprints and prices.

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THE McCONWAY & TORLEY CO., Pittsburgh, Penna.

Superior Wood Pipe

both continuous stave and machine banded, of Redwood and Douglas Fir. Also tanks. **Write.**

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OFFICES:
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GRAVITY FILTERS PRESSURE

For Municipal and Industrial Purposes.

Licensed For "Down Draft or Negative Head."

NORWOOD ENGINEERING COMPANY
FLORENCE, MASS.

Caulking Charges Cancelled

Bell-holes practically eliminated.
Trench pumping expense reduced to minimum. Work finished on time.
These are some of the advantages of using

TRADE **"LEADITE"** MARK

Registered U. S. Patent Office

For Jointing C. I. Water Mains

Leadite lessens labor. It fills every crevice from the yarn to face of bell. It is the efficient joint.

Write for booklet. *Specify Leadite.*
"Leadite Joints Increase In Strength With Age."

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WHY DON'T YOU USE

Wyckoff Wood Pipe

OTHERS DO

Over 1,000 miles of Wyckoff Wood Pipe have been installed in the last three years. It can be furnished and laid at half the cost of cast iron.

IT LASTS AS LONG.

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ELMIRA, N. Y.

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Wears Longest **PIPE** City Water Systems Irrigation

Never Rusts **TANKS** Water, Oil or Acid

NATIONAL WOOD STAVE PIPE is now being specified for Municipal Systems, Irrigation Projects and Mine work.

Low in initial cost, its long life, due to its perfect non-corrosive qualities, makes it highly desirable.

Booklet on request. Address Dept. D.

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Wood Stave Pipes Have Low Construction Costs

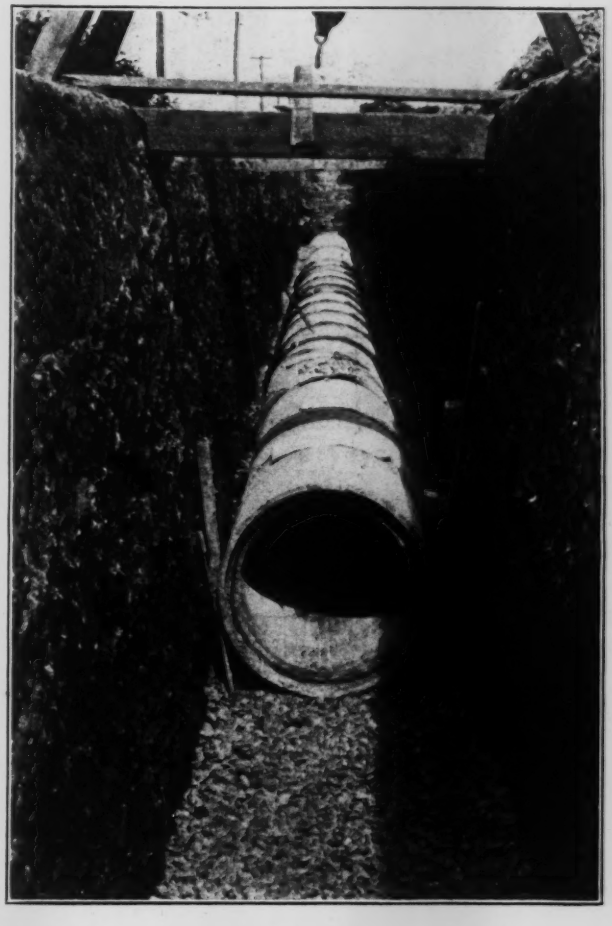
Built at the job—save freight and handling charges.

Joints need no expensive caulking. Pipe easily tapped.

Our engineering department is at your service to help solve your hydraulic problem.

Pacific Coast Pipe Co., Seattle, Wash.

Manufacturers of Machine Wire-Wound and Continuous Stave Wood Pipe.



This is Lock Joint Pipe
The Meriwether System

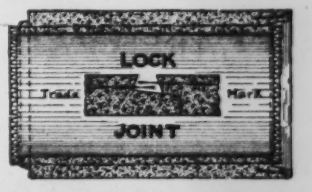
Lock Joint Continuous Reinforced Concrete Pipe is "made in your own city," of local materials and by local labor and, therefore, "keeps your money at home." No freight to pay on pipe.

The joint is doubly reinforced, easily inspected, smooth, water tight and comes on the *inside* of the pipe.

The photo shows 33-in. pipe in Hartford, Ct.

For water lines, sewers and intakes and discharge lines for power houses. 24-in. to 108-in. sizes.

100-page book of photos mailed on request.



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THE CANADIAN LOCK JOINT PIPE CO., Limited
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Long Life. Lasting Accuracy. All parts interchangeable. Maintenance cost nominal.

Their merits have made meter systems popular.

A good article is always worth the price.

All improvements which the tests of time and long service show to be requisite in a **Perfect Water Meter,** are embodied in the **Lambert.**

ONE MODEL ONLY.

Made in all sizes ⅝" to 6" of best bronze Composition throughout, fitted with Unbreakable reinforced disc-pistons.

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GATE VALVES **EDDY** OUR LINE FIRE HYDRANTS

Hydraulically and Electrically Operated Valves and Sluice Gates
Valves Designed for all Kinds of Service.

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New York Chicago Boston San Francisco Philadelphia

Roberts Filter Mfg. Co.

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WATER FILTERS for Municipal and Industrial Plants Gravity and Pressure Types.

CHEMICAL DEVICES

VENTURI METERS

enable you to save money by their accurate measurement of hot and cold water, brine, sewage, chemical solutions, oil, gas, air and steam. Look for next week's full-page ad. **Write for Bulletin No. 84N.**

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Cast-Iron Water, Gas and Flange Pipe, Special Castings, Fire Hydrants, Valves, General Foundry and Machine Work.

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All Sizes
All Pressures
All Purposes

"COREY" FIRE HYDRANTS

Valve Boxes
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Air Valves

RENSSELAER VALVE CO.

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Edson Diaphragm Pumps

Operated by Man or Gasoline Power

will handle Sand, Mud, Gravel, Sanitary Deposits and anything limpid enough to flow, without clogging or injury. *Send for Descriptive Catalogue.*

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Established 1859. 278 Atlantic Avenue, Boston, Mass.

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1009 CHESTNUT ST. PHILADELPHIA, PA.
No affiliation or working agreement with any of our competitors

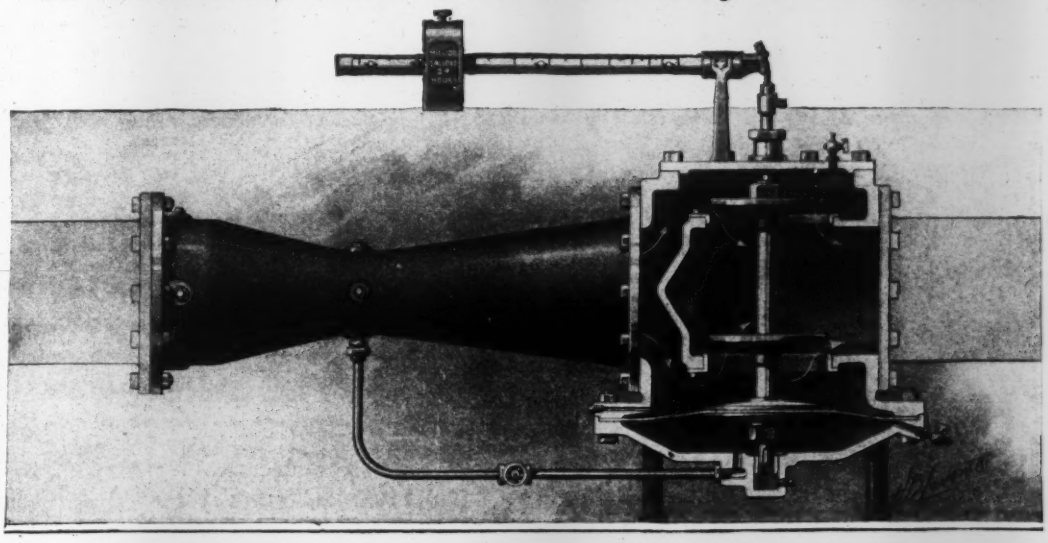
PITTSBURGH FILTER MFG. CO.

PITTSBURGH, PA.

Contractors for Municipal and Industrial Filters, Water Softeners and Sewage Disposal Plants

Licensed Under Fundamental Negative Head Patents

A Constant Flow Automatically Maintained



SIMPLEX RATE CONTROLLER

The exact rate of flow through a filter bed or any pipe line is constantly maintained, regardless of pressure or head variations by Simplex Rate Controllers.

Consist of a balanced valve operated by a diaphragm which is actuated by the pressure difference between the full and throat sections of a Venturi Tube. The valve is balanced by an adjustable external counter weight and lever. **Let us send you interesting Bulletin. Write.**

SIMPLEX VALVE & METER CO. - 112 N. BROAD STREET, PHILADELPHIA, PA.

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APPROVAL

HERSEY DETECTOR METER

The Hersey Detector Meter has been accepted for eleven years in 3", 4", 6", 8", 10" and 12" sizes without any restrictions or conditions of any kind by every Insurance Company, Stock and Mutual, doing business in the United States, and by the Water Departments and Water Companies in more than 500 Cities and Towns for use on over 3,000 Fire Services protecting nearly $2,000,000,000 worth of Insured Property.

HERSEY MANUFACTURING COMPANY

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CHICAGO	ATLANTA	PORTLAND, ORE.

WORTHINGTON TURBINE METER

an integral part of the pipe line

Full description see Bulletin W300-19

It is customary to surround large meters with a by-pass so that in case of accident to the meter the flow of water need not be cut off. This is not essential with the Worthington Turbine Meter. When the moving parts have been removed and the cover replaced, water may be passed through the main casting as part of the pipe line.

Remarkably sensitive on smaller flows, this meter satisfies demands at both extremes of the most exacting service.

Worthington Pump And Machinery Corporation
Works: Harrison, N. J.
New York Office: 115 Broadway
Branch Offices in All Large Cities
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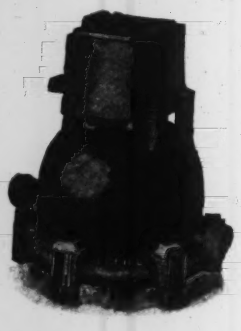
EMPIRE SUPERIORITY



THE LEADING WATER METER

UNRIVALLED FOR ACCURACY,
DURABILITY, EFFICIENCY,
LOW MAINTENANCE COST

NATIONAL METER COMPANY

84 CHAMBERS ST., NEW YORK

ESTABLISHED 1870 JOHN C. KELLEY, PRES.

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LOS ANGELES SAN FRANCISCO LONDON

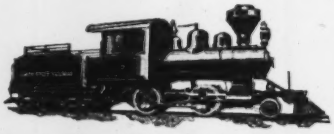
The 2-4-0 type

(Third of a Series)

Where the power and speed requirements are moderate, the 2-4-0 type often has decided advantages.

It usually has a short rigid wheel base, which with the leading pony truck, adapts it particularly to rough track, with short-radius switches and curves.

The free cooperation of Vulcan engineers may be had by writing VULCAN IRON WORKS, Main Street, Wilkes-Barre, Pa., or the offices in New York and Chicago.



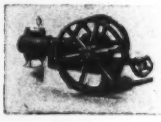
Vulcan Locomotives

A LITTLE AIR ALL THE TIME

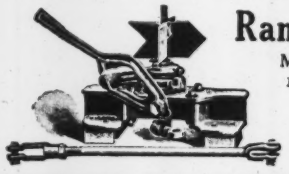
will help you to surprising economies about your work or job, in time, labor and worry.

Send for Bulletin No. 458-P on small belted

SULLIVAN WG3 Air Compressors



SULLIVAN MACHINERY CO.
122 So. Michigan Ave. - Chicago



Ramapo Iron Works

Main Office, Hillburn, N. Y.
New York Office, 30 Church St.

Switch Stands,
Plantation Cars,
Switches, Frogs, Etc.

THE SESSIONS FOUNDRY CO.

BRISTOL, CONNECTICUT

SEWER and SUBWAY
MANHOLE CASTINGS

Sewer Catch-Basin Castings, Etc.

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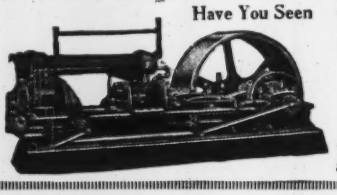

The Norwalk Motor-Driven Compressor?

Full Load, Part Load, No Load, according to demand.

Don't be satisfied with the "as good" kind. Get "IT!"

The Norwalk Iron Works Co.
South Norwalk, Conn.

BACON ∖ FARREL
ORE & ROCK
CRUSHING ∖ WORLD KNOWN
ROLLS-CRUSHERS
EARLE C. BACON, ENGINEER
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Our bulletins describe the successful solution of many materials-handling problems. Let them help you.

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PULVERIZING
AIR-SEPARATING
SYSTEM

FOR THE FINE GRINDING OR PULVERIZING OF ANY MATERIAL
—AS FOR EXAMPLE—

Asbestos	Carbon	Coal	Hard Rubber	Marble Dust
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GRAVITY and PRESSURE FILTERS

Hypochlorite Apparatus and Water Softening Plants.

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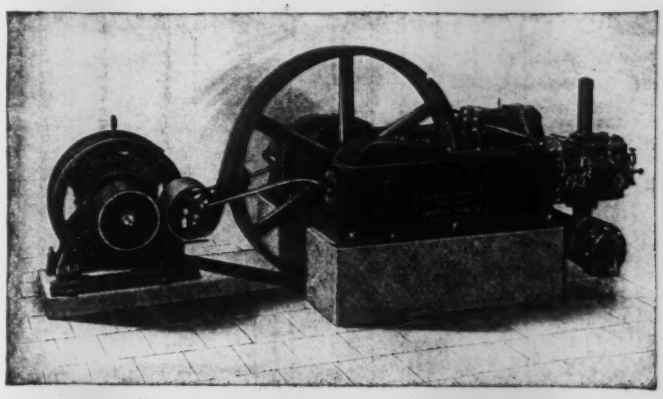
Short Belted Electric Motor Driven Compressors

The advantage of the Short Belt Drive as applied to Ingersoll-Rand Compressors lies not only in a great saving in floor space and initial cost of belt but in more efficient and economical application of power—due to maximum belt contact and the maintenance of a tight belt free from strains and wear due to slippage—and to the fact that standard motors are used.

Short Belt Driven Units can be furnished from stock, in capacities from 3 to 1,190 cubic feet, all ready for placing on foundation, requiring merely connection to station wiring and receiver piping.



SHORT BELT DRIVE IS STANDARD ON INGERSOLL-RAND VERTICAL, STRAIGHT LINE AND DUPLEX COMPRESSORS.

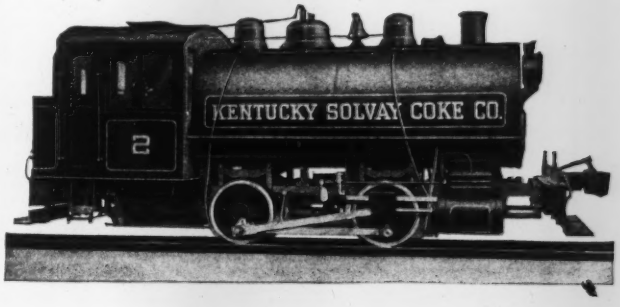
The Imperial Duplex Type illustrated above ranges in capacities from 180 to 1,190 cu.ft. pressures to 110 lb. Ask for Bulletin No. 3035.

INGERSOLL-RAND COMPANY

11 Broadway NEW YORK — **Offices the World Over** — **165 Queen Victoria St. LONDON**

For Canada, address Canadian Ingersoll-Rand Co., Montreal 115-C

INDUSTRIAL LOCOMOTIVES



Designed for all-round service. The minimum number of moving and wearing parts insures low up-keep cost, and their short rigid wheel base makes them suitable for roads with sharp curves and for rough and uneven track.

They are built to insure reliability and constant service. Only tested materials are used in their construction. All wearing parts are made to templets and gauges. This guarantees interchangeability of all parts of locomotives of the same class and size, and avoids long delays when repair parts are needed.

AMERICAN LOCOMOTIVE COMPANY

30 CHURCH STREET, NEW YORK

McCormick Building, Chicago, Illinois. — A. Baldwin & Company, New Orleans, La.

Dominion Express Building, Montreal, Canada.

N. B. Livermore & Company, San Francisco and Los Angeles, California.

Northwestern Equipment Company, Seattle, Wash., and Portland, Oregon.

A Self-Rotating Hammer Drill

is the accepted tool for real economy. No matter what the condition of the rock may be, a **McKiernan-Terry Self-Rotating Hammer Drill** is the one for your work. Less labor, less power and less expense than with any other type of drill. It is the only drill you can afford to use for your work.

Write for our Self-Rotating Hammer Drill Bulletin. It gives full particulars.

McKiernan-Terry Drill Company
234 Broadway, New York

Canadian Representatives, Canadian Allis Chalmers, Ltd., Toronto, Ont.

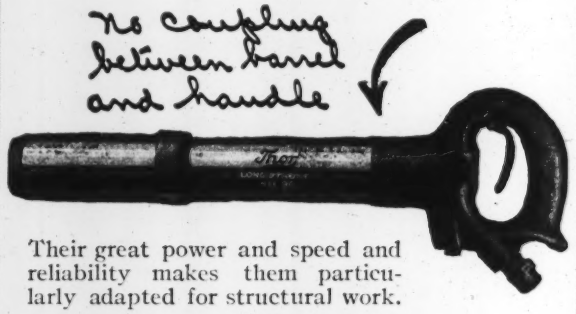
Rock Drills, Core Drills, Pile Hammers, Atlas Jacks.

Here is the Hammer

that drove the rivets on the heaviest office building in the world.

Thor ONE-PIECE Pneumatic Hammers

Drove 1,500,000 Rivets on the EQUITABLE BUILDING IN NEW YORK



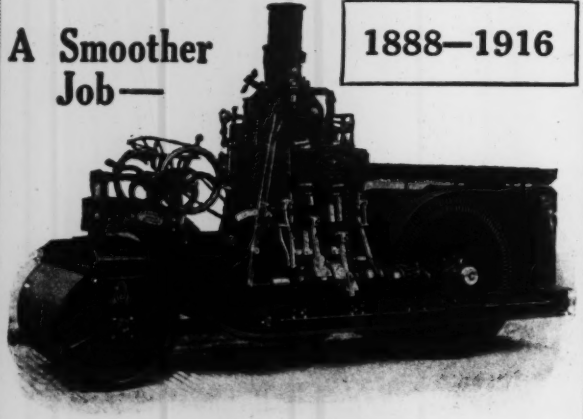
Their great power and speed and reliability makes them particularly adapted for structural work.

Shipped on Trial.

Independent Pneumatic Tool Co.
Chicago New York Pittsburgh San Francisco
Montreal Detroit Birmingham

A Smoother Job—

1888—1916



When Rolled With an Erie Steam Roller

"Easiest to handle on difficult pavement work" is one of the many features predominant in the ERIE Tandem.

Write for the "ERIE BOOKLET" with an interesting account of the construction of these hard service rollers.

Sizes 3, 5, 6½, 8 and 10 tons.

Erie Machine Shops
ERIE, PA.

PRESSED STEEL CAR COMPANY

FREIGHT and PASSENGER CARS
OF EVERY DESCRIPTION

CASTINGS—FORGINGS—WHEELS
PRESSED STEEL PARTS

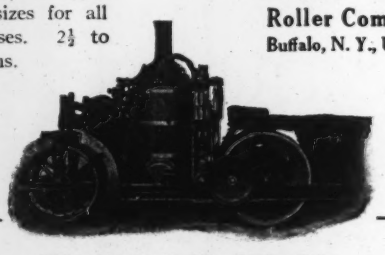
NEW YORK-PITTSBURGH-CHICAGO-WASHINGTON,D.C.

Buffalo Pitts Rollers

Built for Service

Made in all types and sizes for all purposes. 2½ to 20 tons.

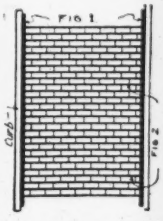
Buffalo Steam Roller Company
Buffalo, N. Y., U. S. A.



Buffalo Pitts Double Drive Tandem Roller

Paved with wood block and Carey Elastite Joint.

The city engineer who specified Elastite Joint for this job took into account the gradient of the street. He realized that in addition to the economy in laying Elastite Joint (instead of the old pouring method) Elastite would give a better footing.



Elastite is especially necessary in wood streets because of the inevitable expansion of the blocks—no matter how well seasoned.

Diagram to left shows how to lay wood block paving straight across, to prevent buckling.

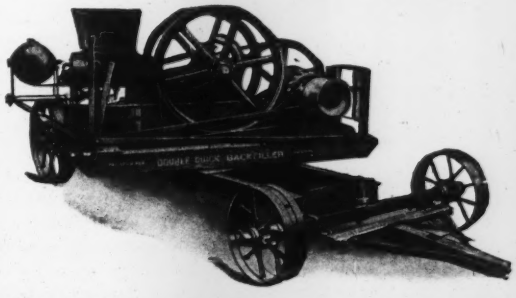
Fig. 1. Shows ½-in. strip Elastite placed along curb line on either side.

Fig. 2. Shows ½-in. strip Elastite between each course of blocks.

When figuring on your next wood block street, write for sample and literature.

The Philip Carey Co., 18 Wayne Ave., Lockland, Cincinnati, Ohio

Takes the Place of 20 Men



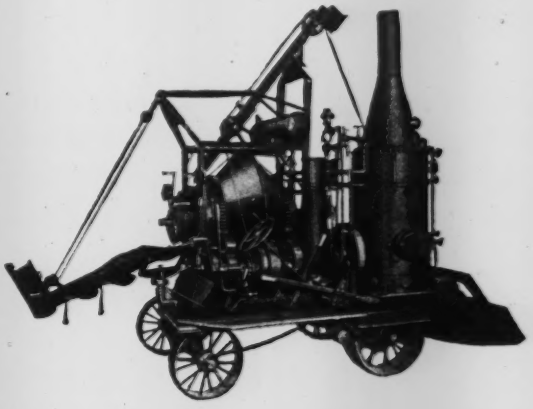
"Double Quick" Backfiller

"Have found the 'DOUBLE QUICK' uniformly satisfactory. It is now taking the place of 20 men filing sewer ditch at expense of one man on the drag, one at engine and the gasoline to run it. The 'DOUBLE QUICK' is a very economical buy for anyone with this kind of work to do."
WM. A. HANSELL, Jr., Supt. Pub. Works, Atlanta, Ga.

If you want to see the dirt fly use the "DOUBLE QUICK." If you want to hoist material, or snake things overground, or "snatch" out teams, or grade, or load and unload—a hundred-odd uses that cut costs and make you "Low Bidder," use the "DOUBLE QUICK."

Send for Bulletin 60

Waterloo Cement Machinery Corporation
115 Vinton Street - - Waterloo, Iowa
Mfrs. Mixers, Pavers and Contractors' Equipment
New York Philadelphia Chicago Kansas City San Francisco



Foote Mixer Operation

EVERY FOOTE A MIXER

The man operating the Foote Paver is stationed on a large platform where there is lots of room to move about, and which is high enough to be out of the way of the rest of the gang, and from which the operator without moving from his operating levers can see the loading of the skip, the mixing in the drum, the discharge of the concrete and the placing of it on the grade.

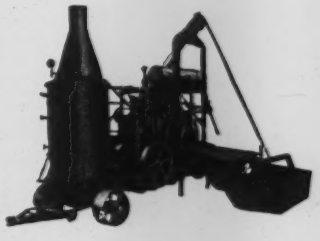
This construction pleases the operator. It helps him in his work. It prevents delays. It means more yardage.

It's just another one of the little reasons why the operator of a Foote Mixer is a Foote booster.

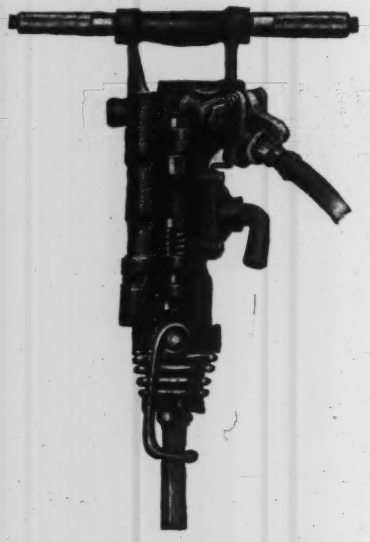
Catalog 7 will show you many reasons why 65% of all Foote sales are repeat orders.

MEMBER OF NATIONAL ASSOCIATION OF MIXER MNFRS.

Foote Concrete Machinery Co., 106 So. La Salle St., Chicago, Ill. Wilcox Bros., Inc., 26 Roosevelt Ave., Binghamton, N. Y. E. J. McHarg & Co., 3 Crandall Street, Binghamton, N. Y. Edward R. Bacon Co., 51 Minna St., San Francisco, Cal. W. C. McAnlis, Imperial Hotel, Detroit, Mich. C. W. Klapproth, 30 Church St., New York City. Geo. H. Sampson Co., Boston, Mass. Henry G. Williams, Atlanta, Ga. Everett, Bradt & Co., Houston, Texas. Victor L. Phillips, Kansas City, Mo., C. C. Dawson Co., Omaha, Neb. Milton B. Wunder, Philadelphia, Pa.
Made by Foote Manufacturing Co., Nunda, N. Y.
Foote Mixer Capacities based on N. A. M. M. Wet Batch Rating.



HUMMER SELF ROTATING HAMMER DRILL



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Mining
Shaft sinking
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Block holing
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Built in three sizes, with or without cradle mounting for use with tripod or column bar.

The compressed air, after operating the rotation motor is discharged into the valve chamber of the hammer cylinder and operates hammer piston by means of a ball valve. This ball valve weighs one ounce, has one-eighth inch travel and is practically indestructible.

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Chicago Pneumatic Tool Company

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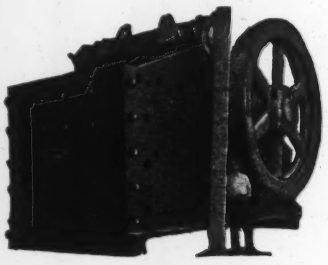
C-1



"Economy in Operation Puts Dollars in Your Pockets"

Traylor Jaw Crushers with Water Cooled Cast Steel Pitman of greatest tensile strength, Water Cooled Main Bearings, perfect Oiling System, Chrome Steel Toggle Blocks and Manganese Steel Jaw Plates, combined with extra heavy Cast Steel Main Frames. Are **economical,** and made in sizes from 7x10 in. up to 66x86 in. Jaw Opening.

Bulletin J-1.

Traylor Engineering & Mfg. Co.
Main Office and Works
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We Design and Build

Locomotive Cranes of Standard and Special Construction — Clam Shell and Concrete Buckets.

Complete Coal Handling Plants including Car Dumpers—Car Hauls, etc.

Shipbuilding Cranes—Railroad Pile Drivers and other special Equipment.

Address your inquiry to the nearest office.

The McMyler Interstate Co., Cleveland, O.
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Here's the best investment

The installation of G-W Coal Pockets and elevating and conveying machinery. Increases efficiency—cuts costs.

Write for full details.

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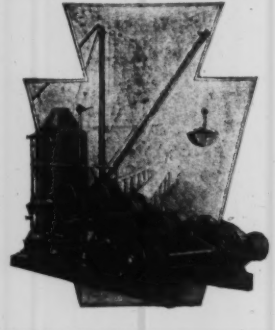
The heaviest hoist—for the heaviest jobs



That's the Flory. It is the heaviest hoist built.

FLORY HOISTS

have convinced many contractors of the desirability of this heavy construction. Not only does it make for longer life, but it enables the hoist to stand that "extra strain"—so frequently confronted in contracting work. **Send for catalog.**

S. Flory Mfg. Company
Bangor, Pa.

Less Men — More Work

"Western" earth and stone handling equipment does away with the shovel gang. Splendid construction and low upkeep makes for instant economy. Worth buying because it costs so little to use. Write for catalog No. 40 full of valuable haulage information.

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Conveying
Elevating
Transmission
Machinery

Coal and Ash Handling
Chain and Sprockets
Sand and Gravel Washing
Contractors' Equipment
Rotary and Shaking Screens

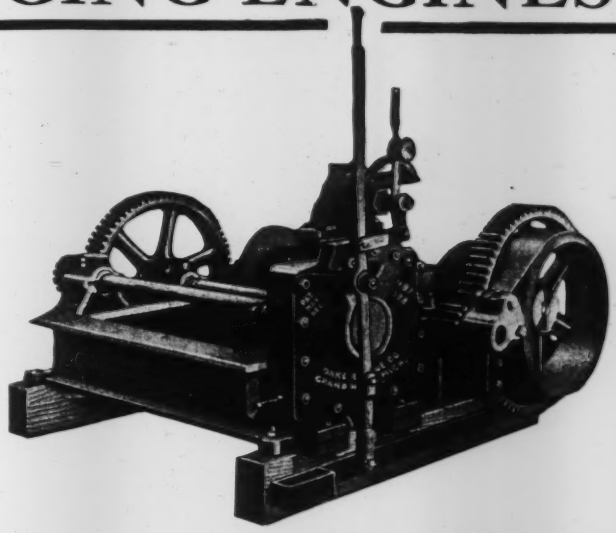
The Webster M'f'g Company, Chicago New York **Tiffin, O.**

DAKE SWINGING ENGINES

"No dead center"—coupled with the new automatic brake attachment combine to make the Dake Independent Swinging Engine the "livest" proposition ever made for derrick swinging.

The operator can start, stop or reverse at the wave of a hand. He can spot the boom just where desired without any danger of damage to gears. The new attachment insures a "cushion" effect with minimum stress on gears while engine is coasting.

You'll find the Dake in use on the fastests job in the country. Write for our comprehensive catalog—see why it should be on your work.



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Manufacturers of Pneumatic and Electric Geared Hoists, Steam and Air Motors, Contractors' Hoists, Swinging Engines, Derrick Crabs, Power Spud Hoists, Drill Hoists, Marine Machinery, etc.

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WITH AUTOMATIC BRAKE

The Most Economical and Satisfactory Method of Handling Your Bags, Barrels, Bales and Boxes is a Jeffrey Portable Conveyer or Stacker.

Jeffrey Portable Stacker

handling bags into and out of storage.

Delivery can be made from a minimum height of 6 ft., 0 in. to a maximum of 14 ft., 6 in. Bags and boxes weighing 340 pounds each are handled as fast as three men can take them from the discharge point.

Being mounted on ball bearing swivel castors, the stacker is easily pushed about by 2 men. A 3-hp. motor is ample for driving.

The Jeffrey Stacker

is built especially for **Heavy Duty,** although of light weight, and to give a maximum of service for the duty performed.

It saves labor and greatly increases the capacity of the warehouse by allowing higher piling.

Send us details of your Handling Problem, and let us show you how the Jeffrey Portable Stacker or Conveyer can effect Big Savings in your Operating Costs.

Jeffrey Portable Conveyer

loading 500-pound barrels at the rate of 180 per hour to shipping platform.

The two points of discharge of 5 ft., 0 in. and 8 ft., 0 in. above the ground not only allow the loading of barrels to car floor or platform, but the stocking of one tier upon the other.

The Rigid Steel Frame is so balanced on 36-in. wheels as to enable one man to move the machine. Conveyer is driven by a 2-hp. motor.

The Jeffrey Mfg. Co., 923 North Fourth Street, Columbus, O.

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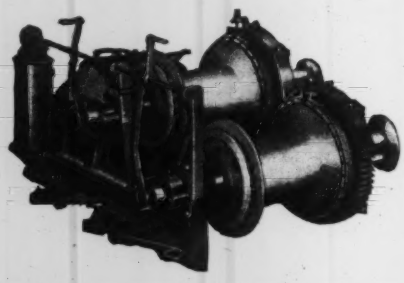

LIDGERWOOD HOISTS

Steam — Electric — Gasoline

Built for speed. Contractors work demands speed. A breakdown is a loss of time. Lidgerwood Quality insures both speed in operation and security against time lost by breakdowns.

Whatever hoist you need we build it.

Cableways— Derricks —Excavators

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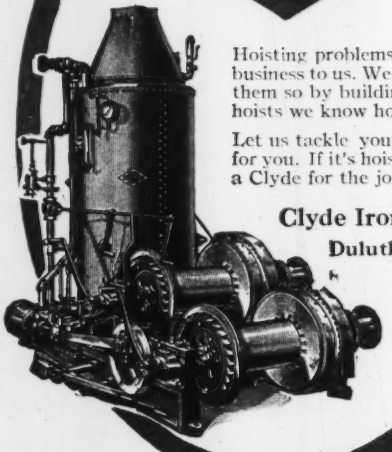

Hoisting problems are a real business to us. We have made them so by building the best hoists we know how.

Let us tackle your problems for you. If it's hoisting, we've a Clyde for the job.

Clyde Iron Works

Duluth, Minn.

Link-Belt Cranes

For Reliable Service

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Heavy Work Requires Good Equipment

INDUSTRIAL WORKS CRANES

Successfully take the Hard Knocks

Catalog 108 shows many photographs of our different machines erecting bridges and buildings and handling material.

Better write for this book now.

INDUSTRIAL WORKS, Bay City, Mich.

——In difficult work the——

O. S. Locomotive Cranes and Buckets

Insure satisfaction.

Correct Design

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WATERBURY WIRE ROPE

of Standard and Armored Construction. Manila and Sisal Cordage. Fibreclad Wire Rope. We make Ropes for every purpose. **Write for prices.**

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63 Park Row - - - New York

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Read the Ruddock

The Ruddock circular gives the full details of the Ruddock Bucket, and of the guarantee which accompanies it.

Read the Ruddock Circular.

The Ruddock Bucket Company, Cleveland, Ohio.

LARGE YARDAGE, easy portability and quick convertibility into a mixer for every job. Rapid loading, fast mixing, quick moves, small crew requirement—these are your demands today. You must have the machine that is profitable whether paving jobs are many or few.

WONDER PAVER

meets these demands plus. Its performance on paving jobs in various parts of the country has shown its great speed, strength and economy. It sustains WONDER reputation.

Drum capacity 10 to 11 cu.ft. per batch. Output 10 to 15 cu.yd. per hour. Discharges at 12, 9 or 6 ft. 8-hp. gas engine. Strong differential; heavy auto steering knuckles. Steered by irreversible worm and gear. Speed 1½ m.p.h. forward, 1 m. reverse. All controls grouped Weight 8,000 lb.

Send for Full Details.

Waterloo Cement Machinery Corporation
115 Vinton St.
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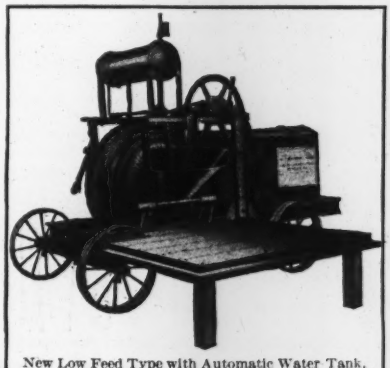
International Concrete Mixers

Meet a Wide Range of Requirements

A Size to Meet Economical Conditions

If you want to get your work done well, and at low cost, without irritating delays and costly breakdowns, post yourself at once on the INTERNATIONAL MIXERS. Our catalog explains their construction fully and shows why they give superior service. Measured by length of satisfactory performance, you will find the INTERNATIONAL the most economical mixer you can own.



New Low Feed Type with Automatic Water Tank, "Ingeco" Kerosene-Gasoline Engine

The New International Low Feed Type is just what the contractors have been looking for, a thoroughly well made, reliable Mixer, with low charging hopper and a reliable, economical oil engine, selling at a moderate price.

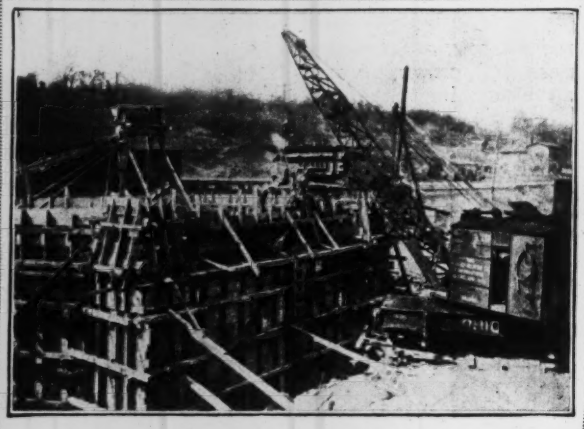
Write for catalog 66N and address of nearest agent.

Worthington Pump And Machinery Corporation
Successor to Power & Mining Machinery Co.
Cudahy, Wis., U. S. A. Suburb of Milwaukee

M 389.4

With Steam Engine and Boiler, Open End Side Loader

With "Ingeco" Kerosene-Gasoline Engine and Closed End Side Loader



THE varied uses to which an Ohio crane can be applied surely justifies its purchase, built, as it is, to withstand severe service. You will find it most economical should you wish to sell it at some future time when you will realize the additional advantages of a crane whose depreciation is unnoticeable. **Write for Catalogue No. 5.**

The Ohio Locomotive Crane Co.
Mansfield St., Bucyrus, Ohio

30 Church St., New York, Fisher Bldg., Chicago
Home Life Bldg., Washington, D. C.
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Edward R. Bacon Co., San Francisco, Los Angeles
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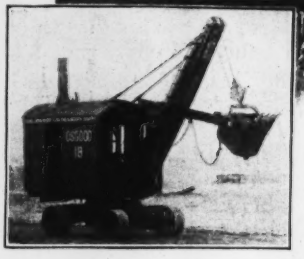
You Will Do Better With An

OSGOOD

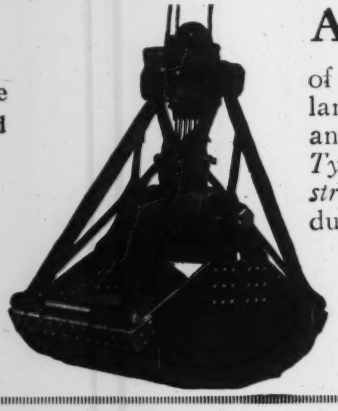


The OSGOOD "18" ¾ yard, traction, revolving steam shovel is designed and built for the lighter class contracting, such as road grading, cellar excavating, sewer trenching, stripping, loading and unloading cars, and in fact, the general line of excavating contracting. The boom raising and lowering device, which can be quickly and easily installed on any standard shovel, enables the operator to dig sewer trenches to a great depth. By attaching a long structural steel boom, in place of the heavy armored boom, the OSGOOD "18" will handle a clam shell bucket or do crane service efficiently.

Steam Shovels—all sizes, Deep Water and Ditching Dredges.

THE OSGOOD COMPANY, MARION, OHIO
Eastern Office, 51 State St., Albany, N. Y.

Improvements in this bucket Greatly increase the Strength and General Operating Efficiency As well as Prolong its Life of Useful Service



A Perfectly Lubricated Bucket

of reinforced steel construction, having exceptionally large bearings which are fully protected from dirt and grit at all times. This briefly describes the *new Type "L" Owen Bucket.* A bucket of *increased strength* without extra weight, *increased digging power* due to absence of friction, and a *longer life of useful service at a very low cost of maintenance.*

Every contractor and engineer will be interested in the new Bulletin No. 5 which gives information in detail. Write today

The Owen Bucket Co
533-535 Rockefeller Bldg., Cleveland, Ohio

Traveling Cranes

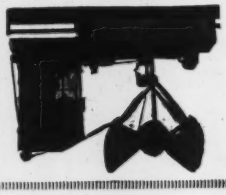
For Power-House and every service. Electric and hand-power. Clearance diagrams and other information for initial layouts gladly furnished to engineers on request. Send for catalog.

We make Tainter Gate Hoists

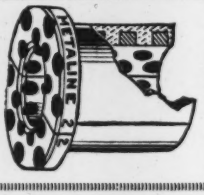
Complete Foundry Plants

WHITING FOUNDRY EQUIPMENT CO HARVEY-ILL. U.S.A.

Cranes of All Kinds



ELECTRIC MONO-RAIL HOISTS
ELECTRIC AND HAND CRANES
Air Hoists
Northern Engineering Works
Detroit, Mich., U. S. A.



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(Trade Mark Reg.)
BUSHINGS for LOOSE PULLEYS
and similar places, positively avert the danger of FIRE which is always present where oil is used for lubrication.
THE METALINE COMPANY
Sole Manufacturers
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HAYWARD BUCKETS

For Digging Sewers at a Profit

HUNDREDS of Contractors are daily using Hayward Clam Shell and Orange Peel Buckets for sewer work. They are making bigger profits through time and labor saved.

Write for our special Sewer Pamphlet. It may help you to solve your digging problems and save money for you.

THE HAYWARD COMPANY

Builders of Orange Peel, Clam Shell, Drag Scraper and Electric Motor Buckets

50 CHURCH STREET, NEW YORK, U. S. A.

WILLIAMS BUCKETS

unfailingly pick up their full rated capacity or better with every grab.

Being fitted with a patented power lever closing mechanism, they present absolutely no obstruction between their wide open jaws which dig deeply into the material. Only *one quarter* of a turn of the main shaft is necessary for complete closure.

The construction is extremely sturdy, all parts being made of steel. The sheaves run on hard bronze bushings. Wear is reduced to the minimum.

Just compare the operating and repair cost of a Williams with that of any other make under similar conditions before you "*decide.*"

Write for catalog and suggestions on YOUR bucket problem.

The G. H. Williams Company

Erie - - - Pennsylvania

On another "Big Job" the BROWNING *is generally useful*

LAST FALL the New York Barge Canal was wiped out for 100 feet by the Ironduquoit Creek. It was an awkward emergency and was an ideal test for the efficiency of the

BROWNING LOCOMOTIVE CRANE

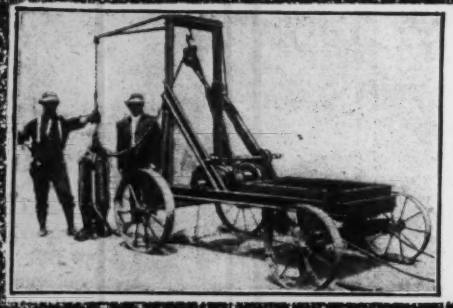
The contract for rebuilding was given to Myers & McWilliams, Contractors. With their Browning and its clam shell bucket they leveled up the creek bottom. With the same crane but with pile-driving leads attached they drove the piles on which to set the conduit for the creek.

Detaching the leads, they set the concrete forms and placed the concrete. The job was done in fast time, the Browning performing at least six different types of work.

Write today for the new Browning catalog with photographs.

The BROWNING CO., Cleveland, O.

Sales Offices: New York Philadelphia Chicago San Francisco



Kuhlman $500.
Sewer Cleaning Outfits

The entire outfit is compact, powerful and serviceable, cleansing thoroughly and collecting refuse as it goes. Our Patented Expansion Bucket fits perfectly any sewer above 8 in., travels easily and makes a thorough job from end to end.

We also make Sewer Rods for particular people. Write us today for details.

Champiou Potato Machinery Co.
334 Sheffield Ave. - Hammond, Ind.

Steam Behind Gravity
for
Positive, Powerful, Driving

—quick, telling blows that are driving steel sheeting, wood piling, concrete piles, and pipe on the smallest as well as the most prominent foundation and underpinning contracts TODAY. And driving them better!

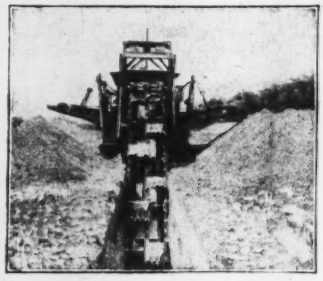
NATIONAL PILE HAMMERS

keep the pile moving in "live" soil — with no "brooming" or "slipping."

Send for our booklet H on pile hammers.

National Hoisting Engine Co.
Harrison, New Jersey

Austin Trenching Machines



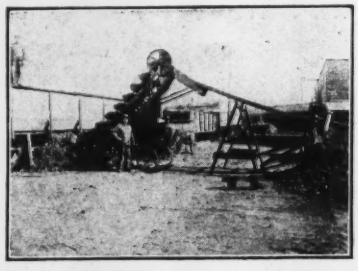
Insure low yardage cost on all kinds of trench excavation. Dig both wide and narrow sizes on same job and are easily adjustable; produce finished trench in single continuous operation; handle the stickiest soil without difficulty owing to selfcleaning buckets; equipped with multipedal traction.

The City of Chicago believes in Austin Trenching Machines —it has purchased **three** of them.

Write us for Catalog No. 102-A with full particulars.

F. C. Austin
Drainage Excavator Co.
Railway Exchange, Chicago

The Haiss Wagon Loader on the Road Contract



The arrangement illustrated should interest the contractor as to the possibilities of the Haiss Digging Wagon Loader on Road Work.

He probably knows that the Haiss is capable of effecting a saving of 10 cents a yard on the handling of crushed stone, sand, gravel, etc. Its convenience is another of its many advantages. **Read the full story in the booklet. We will send you a copy. Write.**

Geo. Haiss Mfg. Company, Inc., 142nd St. and Rider Ave., New York
Also Carried in Stock at
Philadelphia Cleveland San Francisco New York

PARSONS TRENCH EXCAVATOR

One Parsons will dig *several* sizes of trenches. You can select *a* Parsons to cover your season's work. Write for catalog.

See our full-page ad next week or last week.

THE PARSONS CO.
806-8th Ave. - Newton, Iowa
Eastern Sales Office
50 Church Street, New York City

BROWNHOIST Cranes and Hoists

Locomotive cranes, clamshell buckets, dragline excavators and buckets, traveling cranes, electric hoists, crabs, winches, and concrete reinforcement. *Write for catalogs.*

The Brown Hoisting Machinery Co., Cleveland, O.

The "ERIE" For All-Around Shovel Work

The "ERIE" Revolving Shovel handles large yardage in shallow street grading, also heavy excavation work. Watch for half and full-page ads in other issues. Write for Bulletin S-12.

Ball Engine Co., Erie, Penna.

"The Thew Beats All"

William Cram, Des Moines, Iowa said to a disinterested party: "I've operated many steam shovels in my time, but my Thew beats all for easy running, quick loading and cost of operating. Look for yourself—I can't keep teams enough to haul the dirt away. Watch it eat its way into that bank. It grabs rubbish, rocks, etc., just like a hungry man eats a boiled dinner after a hard day's work. It swings clear around—you can't corner it and that horizontal crowding motion can't be beat. Of course I'm enthusiastic—I've been using that machine for three years and it is always on the job."

Here is direct testimony from a man who is an operator—who knows what he is talking about—who has had practical experience.

1,300 Thew Owners will bear similar testimony.

Buy a Thew and you'll be as enthusiastic as Mr. Cram.

Write for circular 26-K and list of Thew Owners near you. The circular describes in detail the new Thew Combination Boom Shovel. The list of Thew Owners will enable you to satisfy yourself.

The Thew Automatic Shovel Co., Lorain, Ohio

For Railroad or Industrial Plant

THE JORDAN SPREADER

Does the Work of an Army of men

If you level loose material to any large extent you should know the Jordan Spreader — it does the work of from 2,500 to 10,000 and more men.

The largest railroads and industrial concerns of the country find it very profitable. You will too.

Full particulars on request.

The O. F. Jordan Company

332 South Michigan Avenue - - Chicago, Ill.

TAKING profitable sewer-digging contracts with Marion Revolving Shovels is *good* business and *profitable* business—for you can handle deep-trench work merely by attaching special boom, dipper and dipper handle to the same outfit you use for general excavating work. You can, in fact,

PUT YOUR "MARION" TO NEARLY ANY JOB

—knowing that it is going to do it *well*, down to the last bucketful.

Successful contractors are using the same "Marions" for road and street-grading, railroad construction, basement excavations, etc., with little change between jobs.

Marion

We Make Excavating Machinery of Every Description

Branches:
Atlanta, Chicago, New York, San Francisco, Seattle

THE MARION STEAM SHOVEL COMPANY

Established 1884 MARION, OHIO

105

Aetna Explosives

"Everywhere East of the Rockies"

No matter what your Blasting Situation may be, AETNA EXPLOSIVES will most satisfactorily serve you. There are many grades of AETNA QUALITY made to suit all conditions, each formulated by the most advanced Explosives Experts—with Safety and Highest Efficiency as first specifications.

AETNA

EXPLOSIVES

Will Do Your Work Right

FOR COAL MINES, ORE MINES, CEMENT QUARRIES, STONE QUARRIES, RAILROAD CONSTRUCTION, STUMP BLASTING, SUB-SOILING, TREE PLANTING, DITCH DIGGING, ETC.

Let us know about your Blasting Work—Your Problems. Let us prove to YOU the Superior Merits of AETNA EXPLOSIVES under all conditions.

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Aetna Explosives Company
Incorporated
New York, N. Y.

"Efficiency" Column Reinforcement

Machine-made spiral hooping. **Continuous, joints electrically welded.** Heavy channel section spacers. Collapsible for shipment. **Cheaper and better than building up your own column reinforcements.** Save time, labor, wages.

"Efficiency" Spiral Column Reinforcement has been thoroughly tested and proven in important structures. Write for complete information.

Deformed Bars — Bar Benders.

Electric Welding Co.
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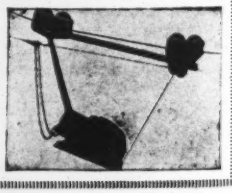

The Cable Excavator Co.
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This will advise that Mr. Edward F. Terry has formed a corporation to be known as the Edward F. Terry Manufacturing Company. This company will carry on the business of manufacturing cranes, derricks, and equipment formerly done by The Terry & Tench Company, Inc.

The business of The Terry & Tench Company, with the exception of the above departments, will be carried on as usual, and the offices of both Companies will be continued at the same address.

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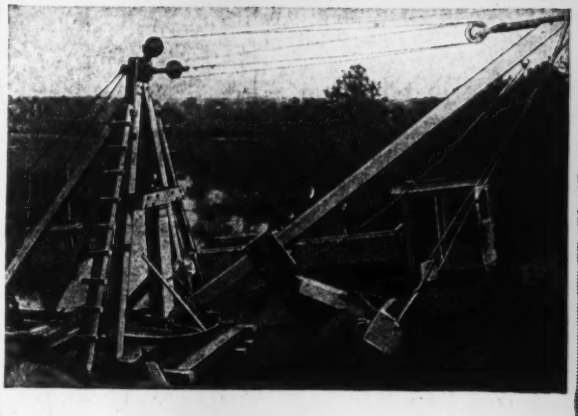

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"I mind, one winter's night, the old woman says, 'Tim,' says she, 'Be sure to put the old cat out before you come to bed.' Old Tab was a layin' on the carpet in front o' me an' I reached down an' ketched aholt of her by the tail, bein' about the most convenient part o' her to git a holt of and started to take her out to th' back door, but she stuck all o' her claws into th' carpet and squalled and spit, an' the ol' woman says, says she, 'Tim, you brute, what you doin' to that poor dumb beast,' an' finally I jest had to take the cat by the neck an' pick her up to get her out a-tail.

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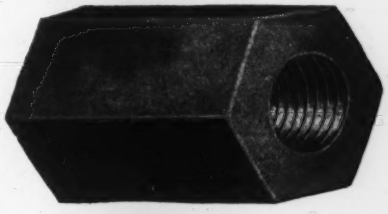

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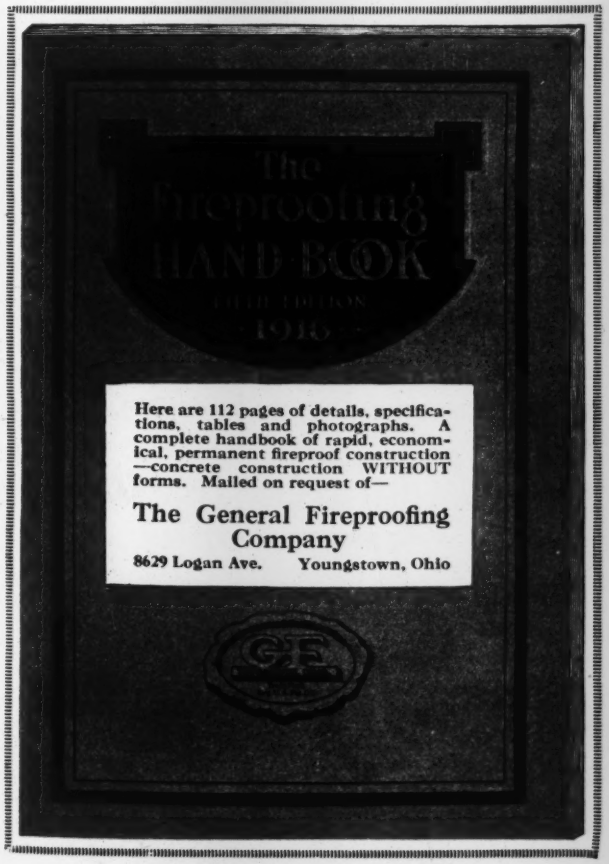

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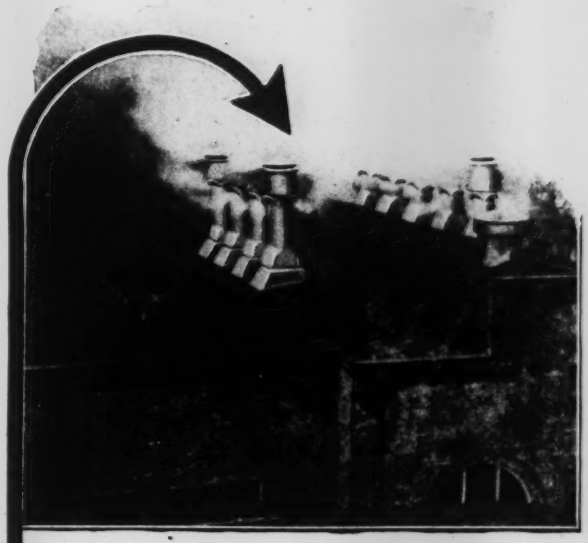

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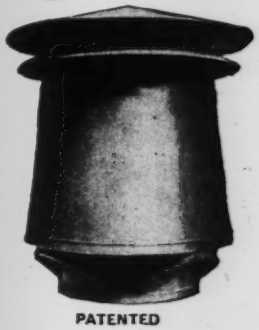

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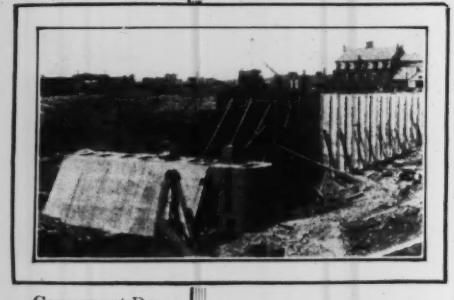

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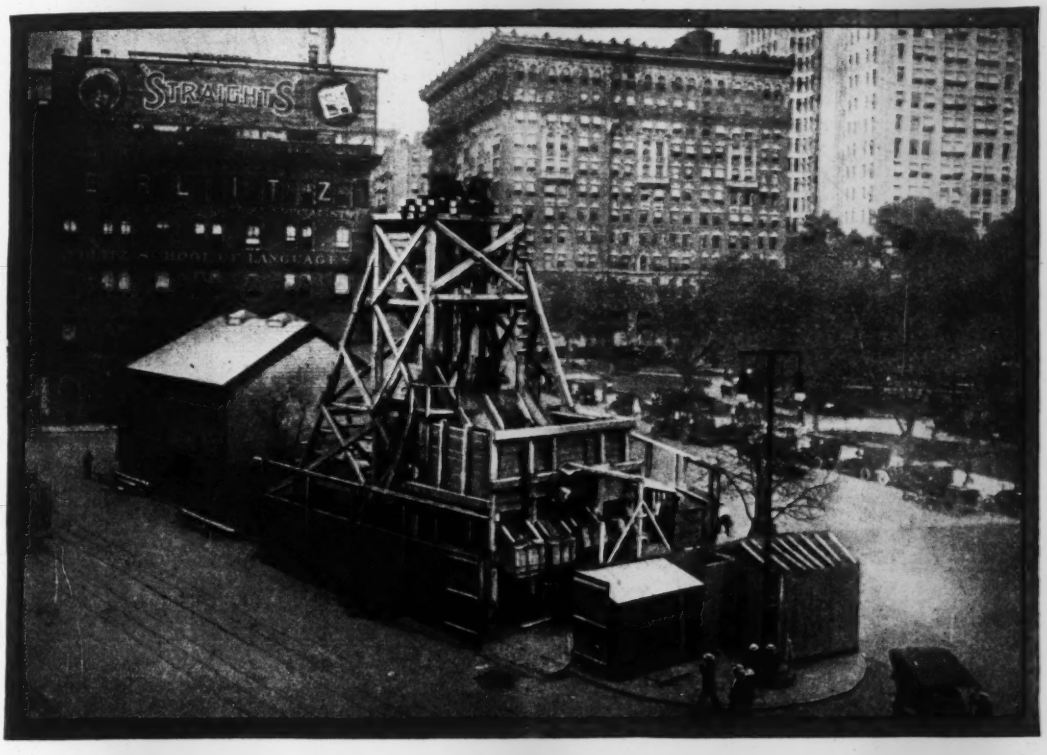

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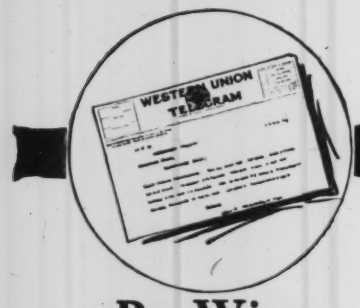

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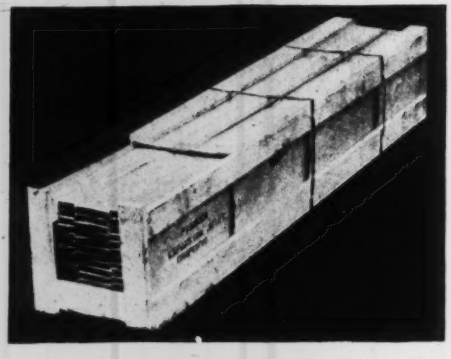

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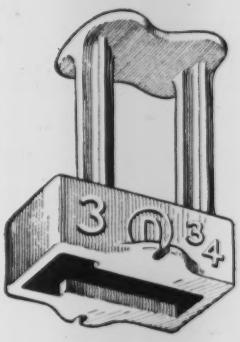

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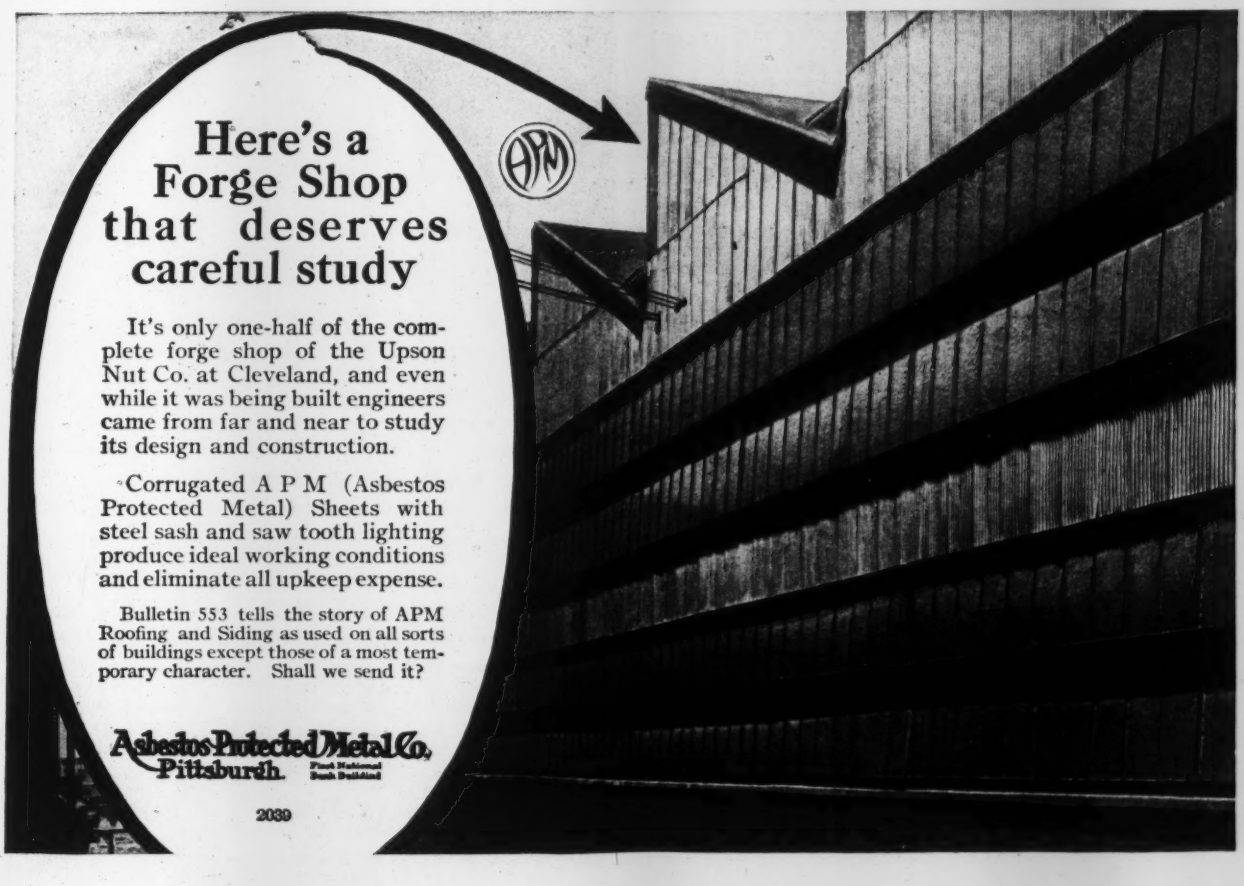

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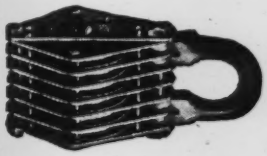

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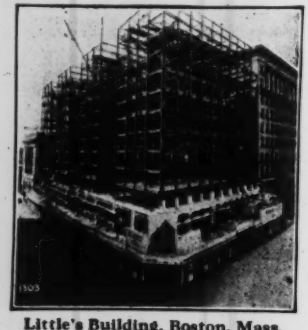

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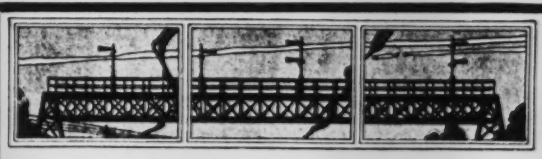

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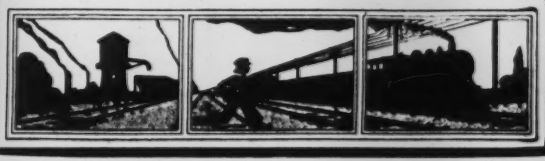

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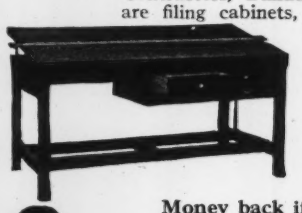

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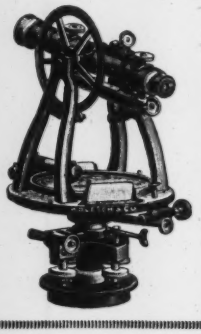

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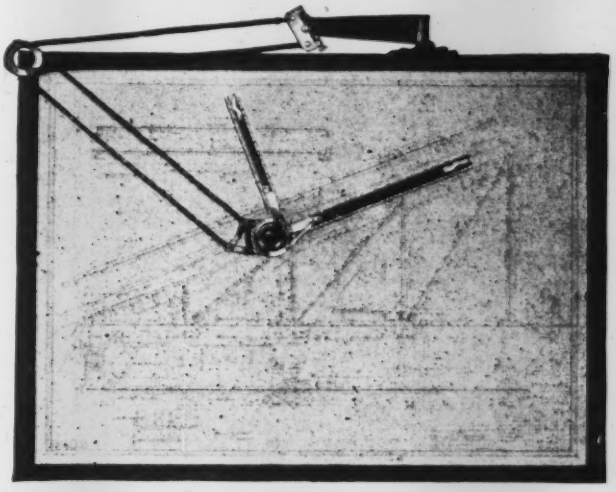

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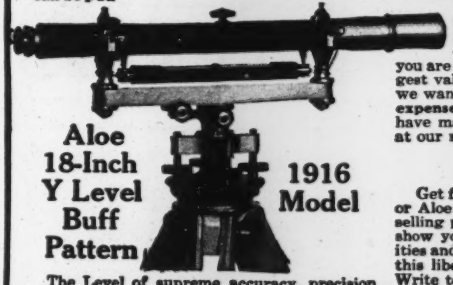

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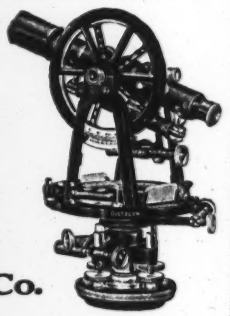

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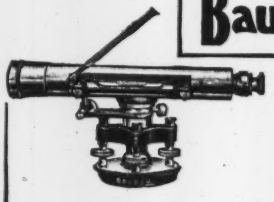

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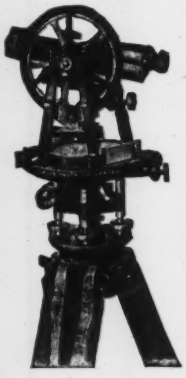

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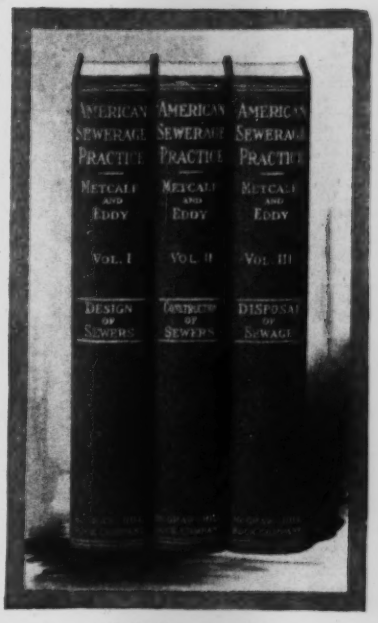

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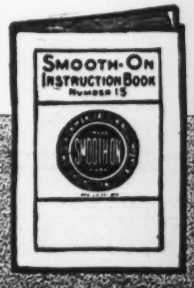

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2. All wire-cut lug brick, subject to slight variations, are of standard size, 8½ inches long by 3½ inches wide and 4 inches deep, and lay 40 brick to a square yard. If local conditions of traffic justify same, these brick can be used 3½ inches or 3 inches deep but of the standard surface measurements.

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4. Wire-cut lug brick are made by 30 independent competing companies and the list is constantly increasing. The brick are marketed at the same price as the repressed brick of the same manufacturer's make, since the small royalty paid is saved in the process of manufacture. The Dunn Wire-Cut Lug Brick Company licenses reputable companies which demonstrate their ability to make good wire-cut lug brick.

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10. If the choice between wire-cut lug brick and repressed brick is left to the contractor, he may, on his first job, use the repressed brick, claiming that the repressed brick takes less filler. We admit this claim, and it substantiates our contention that wire-cut lug brick makes the best pavement, because the filler goes down to the bottom of the brick and insures a good bond its entire depth. After his first experiment, the contractor recognizes this advantage and becomes an advocate of wire-cut lug brick. Wire-cut lug brick are made by 30 independent competing companies, operating 48 plants. Write for data.

The Dunn Wire-Cut Lug Brick Co.

(LICENSORS)

CONNEAUT - - - - OHIO

Heaters, Feed Water
Alberger Heater Co., 281 Chicago St., Buffalo, N. Y.
International Steam Pump Co., 115 Bway., N. Y. C.

Heaters, Service
Alberger Heater Co., 281 Chicago St., Buffalo, N. Y.

Hoists
Clyde Iron Works, Duluth, Minn.
Dake Engine Co., Grand Haven, Mich.
Fairbanks, Morse & Co., Chicago, Ill.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Nat'l Hoisting Eng. Co., Bergen St., Harrison, N. J.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Hoisting Engines
Clyde Iron Works, Duluth, Minn.
Koehring Mach. Co., Portland, Ore.

Hoists, Electric
Brown Hoisting Machinery Co., Cleveland, Ohio.
Fairbanks, Morse & Co., Chicago, Ill.
Flory Mfg. Co., S., Bangor, Penn.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Nat'l Hoisting Eng. Co., Bergen St., Harrison, N. J.
Northern Engineering Works, Detroit, Mich.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.

Hoists, Portable Pneumatic
Ingersoll-Rand Co., 11 Broadway, New York City.

Hoisting Drums
Hayward Co., The, 50 Church St., New York City.

Hoisting Engines
Fairbanks, Morse & Co., Chicago, Ill.
Flory Mfg. Co., S., Bangor, Penn.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Nat'l Hoisting Eng. Co., Bergen St., Harrison, N. J.

Hoppers, Concrete Gravity
Insley Mfg. Co., Indianapolis, Ind.

Hose, Metallic
American Metal Hose Co., Waterbury, Conn.
Pennsylvania Flexible Metallic Tubing Co., Broad and Race Sts., Philadelphia, Penn.

Hose, Steam
American Metal Hose Co., Waterbury, Conn.
Pennsylvania Flexible Metallic Tubing Co., Broad and Race Sts., Philadelphia, Penn.

Hose, Suction
American Metal Hose Co., Waterbury, Conn.
Pennsylvania Flexible Metallic Tubing Co., Broad and Race Sts., Philadelphia, Penn.

Hydrants
Eddy Valve Co., Waterford, N. Y.
Norwood Engr. Co., Florence, Mass.
Rensselaer Valve Co., Troy, N. Y.
Wood & Co., R. D., Philadelphia, Penn.

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Hydraulic Machinery
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Hydraulic Presses
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Wood & Co., R. D., Philadelphia, Penn.

Hydro-Electric Construction
General Electric Co., Schenectady, N. Y.

Indicator Posts
Wood & Co., R. D., Philadelphia, Penn.

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Higgins & Co., C. M., 271 9th St., Brooklyn, N. Y.

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"Trus-Con Slotted," "Kahn Adjustable" and "Trus-Con National Socket" inserts.
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Dietzgen Co., Eugene, Chicago, Ill.
Keuffel & Esser Co., New York. Hoboken, N. J.
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Instruments, Electrical Measuring
General Electric Co., Schenectady, N. Y.

Instruments, Mathematical
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Keuffel & Esser Co., New York. Hoboken, N. J.

Instruments, Surveying
Ainsworth & Sons, Wm., Denver, Colo.
Aloe Co., A. S., 617 Olive St., St. Louis, Mo.
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(See Paving Joints, Expansion)

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Warren Foundry & Machine Co., 11 Broadway, New York City.

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Union Iron Wks., West Shore Sta., Hoboken, N. J.

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Carbic Mfg. Co., New York City.

Lime Kilns
Improved Equipment Co., 60 Wall St., N. Y. City.

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Locomotives, Electric
General Electric Co., Schenectady, N. Y.
Robins Conveying Belt Co., 14 Park Row, N. Y. C.

Locomotives, Industrial
American Locomotive Co., New York City.
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Robins Conveying Belt Co., 14 Park Row, N. Y. C.

Locomotives, Mine
General Electric Co., Schenectady, N. Y.

Lumber
Berlin Mills Co., Portland, Maine.
Bowers Co., S. P., 112 N. Broad St., Phila., Pa.

Manometers
Simplex Valve & Meter Co., Philadelphia, Penn.

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Asbestos Protected Metal Co., Beaver Falls, Pa.
Witherow Steel Co., Pittsburgh, Penn.

Meters, Boiler Feed Water
Builders Iron Foundry, Providence, R. I.
International Steam Pump Co., 115 Bway., N. Y. C.
Pittsburgh Meter Co., East Pitsburgh, Penn.
Worthington, Henry R., 115 Broadway, New York.

Meter Boxes
Ford Meter Box Co., Wabash, Ind.

Meters, Current
General Electric Co., Schenectady, N. Y.
Ritchie & Sons, E. S., 112 Cypress St., Brookline, Mass.

Meters, Oil and Gas
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Hersey Mfg. Co., South Boston, Mass. Cable: Boston, Quohersey. Branches: Boston, N. Y., Phila., Buffalo, Chicago, Columbus, O.; Atlanta, San Francisco, Los Angeles, Portland, Ore.
International Steam Pump Co., 115 Bway., N. Y. C.
National Meter Co., 84 Chambers St., N. Y. City.
Pittsburgh Meter Co., East Pitsburgh, Penn.
Worthington, Henry R., 115 Bway., New York.

Meters, Steam
Builders Iron Foundry, Providence, R. I.

Meter Testing Machines
Ford Meter Box Co., Wabash, Ind.

Meters, Water
Builders Iron Foundry, Providence, R. I. Branches: 30 Church St., N. Y. City; 2437 Oliver Bldg., Pittsburgh; 549 The Rookery, Chicago.
Venturi type. Standard sizes 2 to 60"; larger sizes to order. Capacity—standard tubes—from 3 gal. per m. minimum to 36,100 gal. per m. maximum. Weights from 50 to 58,300 lb.
Contracted tube causing difference between pressures at contraction and inlet. Differences in pressure transmitted by small piping to indicating-recording and register indicator-recording instruments, where difference in pressure is translated into rate of flow units.
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One model, eight sizes—⅝ to 6".
Made in bronze only.
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International Steam Pump Co., 115 Bway., N. Y. C.
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Toch Bros., New York City. Branches: Toronto, Canada; London, England.
Trus-Con Laboratories, The, Detroit, Mich.

Paints, Graphite
Detroit Graphite Co., 120 Broadway, N. Y. City.
Toch Bros., New York City. Branches: Toronto, Canada; London, England.

Paints, Metal Protective
Barrett Company, The, New York City.
Detroit Graphite Co., 120 Broadway, N. Y. City.
Johns-Manville Co., H. W., New York City.
Minwax Co., Inc., 18 W. 41st St., N. Y. City.
National Lead Co., 111 Broadway, New York, N. Y. Cable: Leadco. Branches: New York, Boston, Buffalo, Chicago, Cincinnati, Cleveland, St. Louis, San Francisco.
Steel packages of 12½, 25, 50 and 100 lb. net weight. Price: 100 lb. at 8¼c. per lb.; 25 and 50 lb. at 8½ c. per lb.; 12½ lb. at 8¾c. per lb. On lots of 500 lb. or more prices are ½c. per lb. less. F.o.b. shipping point.
"Dutch Boy" red lead in oil. A protective paint for iron and steel. Red, brown, green and black.
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Looks like a fairly steep grade

Ash-Consaul Bridge, Toledo, paved with Kreolite Lug Wood Blocks

— and it is

It's a 3.97 per cent. grade. Not unusually steep, but just about the grade encountered in many bridge approaches.

That is why the way in which this paving problem was solved ought to be of great interest. Many another bridge presents the same kind of problem. This grade is just steep enough to be mighty slippery if the wrong kind of pavement is used.

The City of Toledo decided to use the greatest possible care in selecting the right paving, not only in the approach to the Ash-Consaul bridge, but also for the bridge itself, in order to save trouble later on.

They decided to get a pavement that wouldn't be slippery on the grade or level. A pavement that wouldn't buckle or bulge when exposed to moisture. A pavement that would give the most possible wear, and prove an economy instead of an expense.

Why the Lugs?

It's the lugs in this Kreolite Wood Block pavement that prevent slipperiness, bulging, buckling and bleeding. Just how they do it is explained fully in our little booklet "Why the Lugs?" Shall we send you a copy?

KREOLITE

LUG WOOD BLOCKS

were chosen. This pavement has been down two years. Others have been down for a greater length of time and all are giving satisfactory service.

The Jennison-Wright Company

Creosoted Bridge Floors, Paving, Piling, Structural Timbers, and Cross Ties.

2462 Broadway, Toledo, Ohio

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Representatives: W. Cooper Huston, 218 Fuller Bldg., Springfield, Mass.; E. M. Humphrey, 556 Rockefeller Bldg., Cleveland, Ohio.
U. S. Gypsum Co., Chicago, Ill.

Paving Blocks, Creosoted Wood
Barber Asphalt Paving Co., Maurer, N. J.
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Representatives: W. Cooper Huston, 218 Fuller Bldg., Springfield, Mass.; E. M. Humphrey, 556 Rockefeller Bldg., Cleveland, Ohio.
All sizes from 3 to 4" in depth.
"Kreolite" lug wood blocks are manufactured with 2 "V"-shaped compressible lugs on one side and one lug on one end, providing a space between each separate row of blocks, giving foothold for horses. When the blocks expand the lugs compress, preventing buckling and bleeding of the floor or pavement.
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Wyckoff Pipe & Creosoting Co., New York City.

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Paving Blocks, Kyanized Wood
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Bessemer Lime Stone Co., Youngstown, Ohio.
Bessimer block, wire-cut-lug and repressed.

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Barrett Co., The, New York City.

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Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
"Kahn Armor Plate" and "Kahn Elastic Filler."
Representatives in principal cities.

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MacArthur Concrete Pile & Foundation Co., 11 Pine St., New York City. Branch offices in principal cities.
The "Pedestal" pile, made-in-place with 16-inch diameter cylindrical shaft and 3-foot diameter base. Made by driving core and casing into ground; ramming out concrete to form base; filling casing with concrete and removing casing; leaving completed pile in place.
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The "Raymond Standard" concrete pile is of the cast-in-place type and is made by driving an expanded steel core, covered with a reinforced sheet steel shell, into the ground to proper resistance. The core is collapsed and withdrawn and the shell left in the ground. Inspected and filled with concrete. The concrete and its protecting shell form the completed pile.
See ad. always on page 3.
Simplex Concrete Piling Co., Tacony, Phila., Pa.
Underpinning & Foundation Co., 290 Broadway, New York City.

Pile Drivers
Browning Co., The, Cleveland, Ohio.
McKiernan-Terry Drill Co., 234 Bway., N. Y. C.
Union Iron Wks., West Shore Sta., Hoboken, N. J.

Pile Hammers
National Hoisting Engine Co., Harrison, N. J.

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Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Arched-web, straight-web, center-flange, plate steel and protected types. Lengths and strengths suitable to cofferdam, retaining wall, core wall, curtain wall, shore revetment work, etc.
See advertisement.

Piling, Steel
Smith, Hauser & MacIsaac, Inc., 18 E. 41st St., New York City.
Underpinning & Foundation Co., 290 Broadway, New York City.

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Berlin Mills Co., Portland, Maine.
Bowers Co., S. P., 112 N. Broad St., Phila., Pa.
Jennison-Wright Co., 320 Huron St., Toledo, Ohio.
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"Asbestocel"—low-pressure steam and heating.
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Wyckoff & Son, A., Elmira, N. Y.

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American Pipe & Construction Co., 112 N. Broad St., Philadelphia, Penn.
Byers Co., A. M., Pittsburgh, Penn.
Clow & Sons, Jas. B., Chicago, Ill.
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Fox & Co., John, 253 Broadway, New York City.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Lynchburg Foundry Co., Lynchburg, Va.
Massillon Iron & Steel Co., Masillon, Ohio.
National Tube Co., Pittsburgh, Penn.
Standard Cast Iron Pipe & Fdry. Co., Bristol, Pa.
United States Cast Iron Pipe & Foundry Co., Philadelphia, Penn.
Warren Fdry. & Machine Co., 11 Bway., N. Y. C.
Wood & Co., R. D., 400 Chestnut St., Phila., Pa.

Only reliable goods can be advertised continuously—Only reliable and responsible concerns are listed here.

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Leadite Co., Inc., The, Land Title Bldg., Philadelphia, Penn.

Pipe, Reinforced Concrete
Lock Joint Pipe Co., 165 Broadway, N. Y. City.

Pipe, Riveted Steel
Chicago Bridge & Iron Works, Chicago, Ill.
East Jersey Pipe Co., Fulton and Church St., New York City.
Gillespie Co., T. A., New York City.
McNeil & Bro., James, Pittsburgh, Penn.
Riter-Conley Mfg. Co., Pittsburgh, Penn.
Struthers-Wells Co., Warren, Penn. N. Y. City.
Tippett & Wood, Phillipsburg, N. J.

Pipe Specials
Builders Iron Foundry, Providence, R. I.
Byers Co., A. M., Pittsburgh, Penn.
Wood & Co., R. D., 400 Chestnut St., Phila., Pa.

Pipe, Spiral Riveter
Abendroth & Root, 45 Broadway, N. Y. City.

Pipe, Steel
National Tube Co., Pittsburgh, Penn.

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National Fire Proofing Co., Pittsburgh, Penn.

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National Tank & Pipe Co., Portland, Oregon.
Two inches to 14 feet diameter, up to 300' head.
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Portland Wood Pipe Co., Portland, Oregon.
Standard Wood Pipe Co., Williamsport, Penn.
Washington Pipe & Foundry Co., 1512-1620 Center St. and 3001-3019 Asotin St., Tacoma, Wash. Cable: Wash Pipe.
Sizes from 2 inches up. Machine banded, continuous stave and special pipe.
Wyckoff & Son Co., A., Elmira, N. Y.
Wyckoff Pipe & Creosoting Co., New York City.

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Berlin Mills Co., Portland, Maine.
National Tank & Pipe Co., Portland, Oregon.

Poles, Tubular Steel
American Bridge Co., 30 Church St., N. Y. City
Franklin Steel Works, Franklin, Penn.
Mill capacity, 100 poles per day.
Various types for all electric service.
National Tube Co., Pittsburgh, Penn.

Portable Pneumatic Hoists
Ingersoll-Rand Co., 11 Broadway, New York City.

Powder
Aetna Explosives Co., Inc., 2 Rector St., N. Y. C.

Power Transmission Machinery
Bacon, Earle C., Havemeyer Bldg., New York.
Jeffrey Mfg. Co., The, 923 N. 4th St., Columbus, O.
Leffel & Co., James, Springfield, Ohio.
Webster Mfg. Co., The, Tiffin, Ohio.

Pumps, Air
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
International Steam Pump Co., 115 Bway., N. Y. C.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Pumps, Air Lift
Ingersoll-Rand Co., 11 Broadway, New York City.
International Steam Pump Co., 115 Bway., N. Y. C.
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, The, Aurora, Ill.
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Branches in all principal cities.
Cameron Steam Pump Wks., A. S., 11 Broadway, New York City.
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Erie Pump & Equipment Co., Erie, Penn.
International Steam Pump Co., 115 Bway., N. Y. C.
Lawrence Machine Co., Lawrence, Mass.
Lawrence Pump & Engine Co., Lawrence, Mass.
Morris Machine Works, Baldwinsville, N. Y.
Pelton Water Wheel Co., San Francisco, Calif.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Worthington, Henry R., 115 Bway., N. Y. City.

Pumps, Contractors'
Bond Co., Harold L., Boston, Mass.
Buffalo Steam Pump Co., Buffalo, N. Y.
Branches in all principal cities.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Erie Pump & Equipment Co., Erie, Penn.
Fairbanks, Morse & Co., Chicago, Ill.
International Steam Pump Co., 115 Bway., N. Y. C.
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Parker, A. A., Waterford, N. Y.
Pulsometer Steam Pump Co., New York City.
Van Nouhuys Mach. Works, Albany, N. Y.
Worthington, Henry R., 115 Bway., New York.

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American Well Works, The, Aurora, Ill.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Cook, A. D., Lawrenceburg, Ind.
For 2 to 12' wells. Cap. 500 gal. per m.
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Bond Co., Harold L., Boston, Mass.
Boston & Lockport Block Co., Boston, Mass.
Edson Mfg. Co., 278 Atlantic Ave., Boston, Mass.
3 sizes, 2½, 3 and 4" suc. 1800-6000 gal. per hr.
Parker, A. A., Waterford, N. Y.

Pumps, Dredging
Buffalo Steam Pump Co., Buffalo, N. Y.
Branches in all principal cities.
Fairbanks, Morse & Co., Chicago, Ill.
International Steam Pump Co., 115 Bway., N. Y. C.
Lawrence Machine Co., Lawrence, Mass.
Lawrence Pump & Engine Co., Lawrence, Mass.
Morris Machine Works, Baldwinsville, N. Y.
Parker, A. A., Waterford, N. Y.
Worthington, Henry R., 115 Broadway, N. Y. City.

Pumps, Gasoline Portable
Parker, A. A., Waterford, N. Y.

Pumps, Power
Buffalo Steam Pump Co., Buffalo, N. Y.
Branches in all principal cities.
Cook, A. D., Lawrenceburg, Ind.
McGowan Co., John H., Cincinnati, Ohio.

Pumps, Steam
Buffalo Steam Pump Co., Buffalo, N. Y.
Branches in all principal cities.
Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
Fairbanks, Morse & Co., Chicago, Ill.
Keystone Driller Co., Beaver Falls, Penn.
McGowan Co., John H., Cincinnati, Ohio.
Morris Machine Works, Baldwinsville, N. Y.
Worthington, Henry R., 115 Bway., New York.

Pumps, Turbine
American Well Works, The, Aurora, Ill.
Buffalo Steam Pump Co., Buffalo, N. Y.
Branches in all principal cities.

BITOSLAG

REG. U. S. PATENT OFFICE

Contract for one-and-a-half miles of Bitoslag Pavement was recently awarded by the Commissioners of Allegheny County, Pa.

It was in McKeesport, Allegheny County, Pa. that the durability of BITOSLAG was demonstrated by five years service test.

BITOSLAG is an improved asphaltic concrete pavement manufactured by special process, using pulverized slag as the principal mineral aggregate.

BITOSLAG has a gritty surface; is malleable at low temperatures; unaffected by heat; and in every way possesses all the essentials of a high-grade pavement.

For complete information regarding BITOSLAG pavement address,

BITOSLAG PAVING CO.

90 WEST ST. - - NEW YORK

Cameron Steam Pump Works, A. S., 11 Broadway, New York City.
General Electric Co., Schenectady, N. Y.
Kerr Turbine Co., Wellsville, N. Y.
Lawrence Machine Co., Lawrence, Mass.
Lawrence Pump & Engine Co., Lawrence, Mass.
Morris Machine Works, Baldwinsville, N. Y.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Worthington, Henry R., 115 Broadway, N. Y. City.

Purifiers, Feed Water
N. Y. Cont'l Jewell Filtration Co., New York.
Norwood Engr. Co., Florence, Mass.

Rails and Fastenings
Carnegie Steel Co., Pittsburgh, Penn.
Lackawanna Steel Co., Lackawanna, N. Y. Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Standard heavy and light sections, contact rails, angle and splice bars, joint plates, tin plates, track spikes and bolts.

Reinforcing Materials
Asbestos Protected Metal Co., Beaver Falls, Pa.

Riveters
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Rivets
Pennsylvania Steel Co., Steelton, Penn.

Road Oils and Preservatives
Barber Asphalt Paving Co., Maurer, N. J.
Barrett Co., The, New York City.

Road Rollers
Austin Mfg. Co., Chicago, Ill.
Austin Western Road Machy. Co., Chicago, Ill.
Buffalo Steam Roller Co., Buffalo, N. Y.
Erie Machine Shops, Erie, Penn.

Rolls, Crushing
Buchanan Co., C. G., 90 West St., N. Y. City.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Roofing
American Cement Tile Mfg. Co., Oliver Bldg., Pittsburgh, Penn.
Reinforced cement roofing; tile for pitched and flat roofs.
Barrett Co., The, New York City.
Carey Co., Philip, 18 Wayne Ave., Lockland, Ohio.
General Fireproofing Co., Youngstown, Ohio.
Johns-Manville Co., H. W., New York, N. Y.
Asbestos fire and acid resisting. Built-up; Roll—all weights and types; Corrugated; Shingles.

Roofing, Metal
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Asbestos Protected Metal Co., Beaver Falls, Pa.
Johns-Manville Co., H. W., New York City.
Youngstown Iron & Steel Co., Youngstown, Ohio.

Rope, Manila
Broderick & Bascom Rope Co., St. Louis, Mo.
Waterbury Co., The, 63 Park Row, N. Y. City.

Rope, Transmission
Waterbury Co., The, 63 Park Row, N. Y. City.
Webster Mfg. Co., The, Tiffin, Ohio.

Rope, Wire
American Steel & Wire Co., Chicago, Ill.
Waterbury Co., The, 63 Park Row, N. Y. City.

Sash, Steel (See Window Sash, Steel)

Screens, Rotary
Jeffrey Mfg. Co., The, Columbus, Ohio.
Webster Mfg. Co., The, Tiffin, Ohio.

Screens, Well
American Well Works, The, Aurora, Ill.

Searchlights
General Electric Co., Schenectady, N. Y.

Second-Hand Equipment
(See Alphabetical Index for For Sale Ads.)
Astoria Light, Heat & Power Co., The, East 132d St. and Locust Ave., New York City.
Bradley Contracting Co., 1 Madison Ave., N. Y. C.
Contractors Machy. & Supply Co., 645 Wabash Bldg., Pittsburgh, Pa.
Municipal Engineering & Contracting Co., Chicago, Ill.

Sewage Screens
Sanitation Corp., 50 Church St., New York.

Sewer Blocks, Segmental
American Sewer Pipe Co., Akron, Ohio.

Sewer and Drain Tile
National Fire Proofing Co., Pittsburgh, Penn.

Sewer Cleaning Machinery
Champion Potato Machinery Co., Hammond, Ind.
Patented expansion sewer cleaning bucket. Patented sewer trolley jacks. Sewer rods.

Sharpening Machines (Drill Bit)
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

Sheaves
Haiss Mfg. Co., 142d St. and Rider Ave., N. Y. C.
Marion Malleable Iron Works, Marion, Ind.

Shovels, Power
Ball Engine Co., Erie, Penn.
"Erie Steam and Electric Revolving Shovels."
Marion Steam Shovel Co., Station M, Marion, O. Cable: Barnhart. Branches: Atlanta, Chicago, New York, San Francisco, Seattle.
Electric, steam or gasoline power equipment. All standard sizes and capacities.
Osgood Co., The, Marion, Ohio.
Thew Automatic Shovel Co., Lorain, Ohio.

Shutters, Steel and Wood Rolling
Kinnear Mfg. Co., Columbus, Ohio.

Sidewalk Forms
Blaw Steel Construction Co., Pittsburgh, Penn.

Sidings
General Fireproofing Co., Youngstown, Ohio.
Johns-Manville Co., H. W., New York City.

Skips
Insley Mfg. Co., Indianapolis, Ind.

Sluice Gates
Coldwell-Wilcox Co., Newburgh, N. Y.

Softeners, Water
American Water Softener Co., Philadelphia, Pa.
N. Y. Cont'l Jewell Filtration Co., New York.
Roberts Filter Mfg. Co., Darby, Penn.

No use to file this list for future reference, a new one will be out next week, right up to the minute

Spreaders, Ballast
Jordan Co., The O. F., McCormick Bldg., Chicago, Ill.

Stacks, Steel
Chicago Bridge & Iron Works, Chicago, Ill.
Wiederholdt Construction Co., St. Louis, Mo.

Standpipes
Chicago Bridge & Iron Works, Chicago, Ill.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Struthers-Wells Co., Warren, Penn. N. Y. City.
Tippett & Wood, Phillipsburg, N. J.
Walsh's Holyoke Steam Boiler Works, Holyoke, Mass.

Steam Hammers
Nat'l Hoist. Eng. Co., Bergen St., Harrison, N. J.

Steam Traps
Johns-Manville Co., H. W., New York City.

Steel (Plates and Bars)
Carnegie Steel Co., Pittsburgh, Penn.
Open hearth, Bessemer and alloy steels.
Corrugated Bar Co., Buffalo, N. Y.
Lackawanna Steel Co., Lackawanna, N. Y. Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Sheared and universal plates, sheet bars, merchant bars in rounds, squares, flats, ovals, half ovals and hexagons.

Steel Plate Construction
American Bridge Co., 30 Church St., N. Y. City.
Blaw Steel Construction Co., Pittsburgh, Penn.
Chicago Bridge & Iron Works, Chicago, Ill.
Coatesville Boiler Works, 30 Church St., N. Y. C.
East Jersey Pipe Co., Fulton and Church St., New York City.
Franklin Steel Works, Franklin, Penn.
McNeil & Bro., James, Pittsburgh, Penn.
Pennsylvania Steel Co., Steelton, Penn.
Riter-Conley Mfg. Co., Pittsburgh, Penn.
Struthers-Wells Co., Warren, Penn.
Turl Iron & Car Co., 50 Broad St., N. Y. City.
Tippett & Wood, Phillipsburg, N. J.
Walsh's Holyoke Steam Boiler Works, Holyoke Mass.
Williams Co., G. H., Cleveland, Ohio.

Steel, Structural
American Bridge Co., 30 Church St., New York.
Belmont Iron Wks., Phila. 32 Broadway, N. Y. C
Mill capacity, 4,000 tons monthly.
Berlin Construction Co., Berlin, Conn.
Blaw Steel Construction Co., Pittsburgh, Penn. 165 Broadway, New York City. Peoples Gas Bldg., Chicago.
Carnegie Steel Co., Pittsburgh, Penn.
Beams, channels, angles and structural shapes.
Case Crane & Engineering Co., Columbus, Ohio.
Chicago Bridge & Iron Works, Chicago, Ill.
Eastern Bridge & Structural Co., Worcester, Mass.
Fort Pitt Bridge Works, Pittsburgh, Penn.
Franklin Steel Works, Franklin, Penn.
Kenwood Bridge Co., Chicago, Ill.
King Bridge Co., Cleveland, Ohio.
Lackawanna Bridge Co., New York.
Lackawanna Steel Co., Lackawanna, N. Y. Branches: New York, Boston, Buffalo, Philadelphia, Cleveland, Cincinnati, Chicago, Detroit, St. Louis, Atlanta, San Francisco.
Standard structural beams, angles and channels.
MacKinnon-Holmes & Co., Sherbrooke, Que., Can.
McClintic-Marshall Co., Pittsburgh, Penn.
Milwaukee Bridge Co., Milwaukee, Wis.
Minneapolis Steel & Machry. Co., Minneapolis.
Morava Construction Co., Chicago, Ill.
Mount Vernon Bridge Co., Mt. Vernon, Ohio.
Penn Bridge Co., Beaver Falls, Penn.
Phoenix Bridge Co., Phoenixville, Penn.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Mfg. Co., Pittsburgh, Penn.
Riverside Bridge Co., Martins Ferry, Ohio.
Shoemaker & Co., Lewis F., Pottstown, Penn.
Snare & Triest Co., Woolworth Bldg., N. Y. C.
Strauss Bascule Bridge Co., Chicago, Ill.
Terry Mfg. Co., E. F., Grand Central Terminal, New York City.
Variety Iron & Steel Works, Cleveland, Ohio.
Wisconsin Bridge & Iron Co., Chicago, Ill.

Stokers
Babcock & Wilcox Co., The, 85 Liberty St., New York City. Works: Barberton, Ohio. Branch offices in principal cities.

Strainers, Well
Cook, A. D., Lawrenceburg, Ind.

Superheaters, Steam and Air
Power Specialty Co., 111 Broadway, N. Y. City. Boston, Philadelphia, Pittsburgh, Chicago.

Swinging Gear
Dake Engine Co., Grand Haven, Mich.

Switchboards and Switches
General Electric Co., Schenectady, N. Y.

Tables and Boards, Drawing
American Drafting Furniture Co., Rochester, N. Y.
Keuffel & Esser Co., New York. Hoboken, N. J.

Tanks, Automatic Sprinkler
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

Tanks, Concrete
Concrete Steel Co., New York City.

Tanks and Towers
American Bridge Co., 30 Church St., N. Y. City.
Blaw Steel Construction Co., Pittsburgh, Penn.
Chicago Bridge & Iron Works, Chicago, Ill.
Coatesville Boiler Works, 30 Church St., N. Y. C.
Pacific Tank & Pipe Co., 5th & Bryant St., San Francisco, Calif.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Struthers-Wells Co., Warren, Penn.
Tippett & Wood, Phillipsburg, N. J.
Walsh's Holyoke Steam Boiler Works, Holyoke, Mass.

Tanks, Wood
National Tank & Pipe Co., Portland, Oregon.
Pacific Tank & Pipe Co., 5th and Bryant St., San Francisco.
Portland Wood Pipe Co., Portland, Oregon.
Washington Pipe & Foundry Co., 1512-1620 Center St. and 3001-3019 Asotin St., Tacoma, Wash. Cable: Wash Pipe.

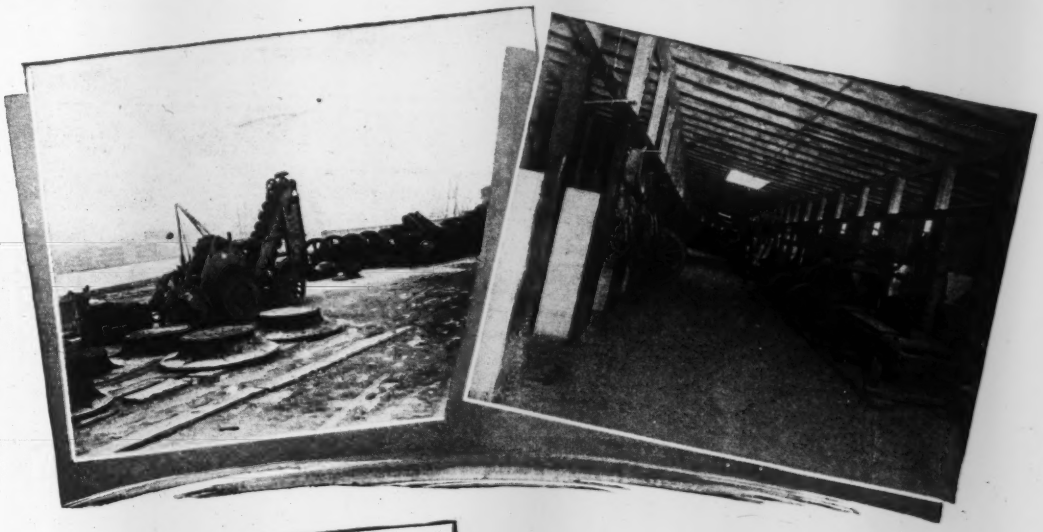
Tapes, Steel and Metallic
Aloe Co., A. S., 617 Olive St., St. Louis, Mo.
Dietzgen Co., Eugene, Chicago, Ill.
Keuffel & Esser Co., New York. Hoboken, N. J.
Lufkin Rule Co., Saginaw, Mich. N. Y. City;

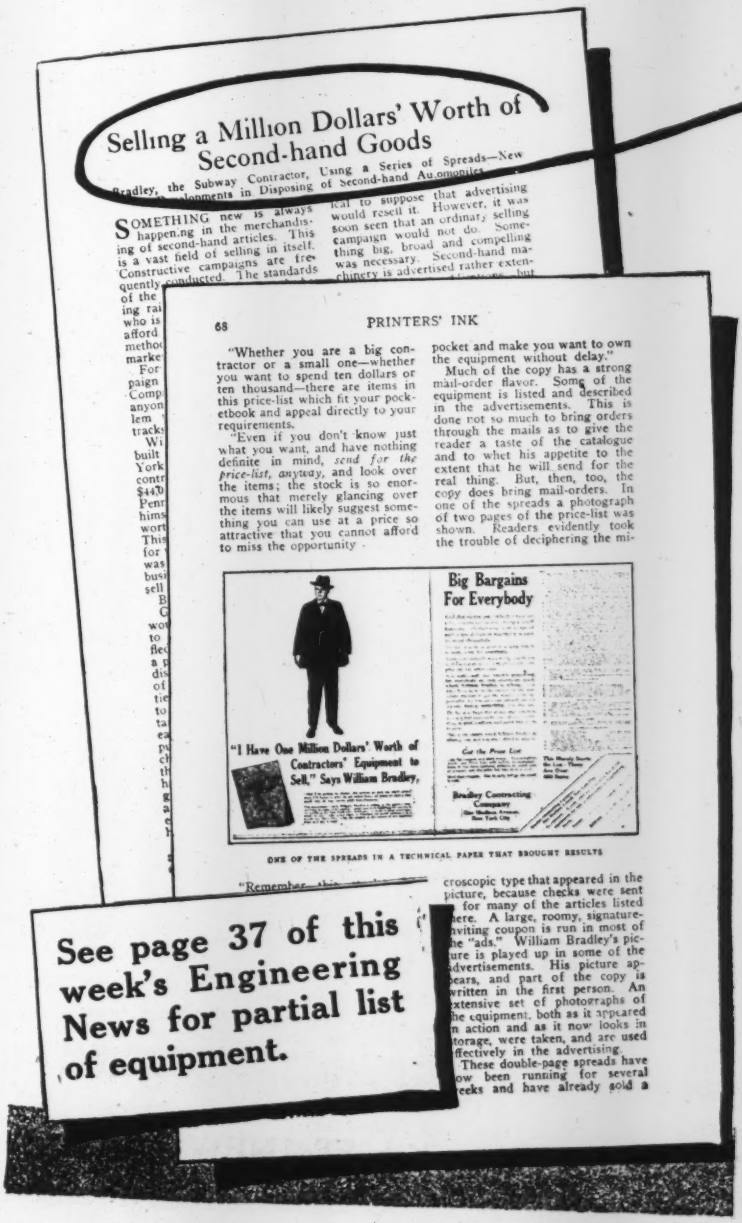
Test Boring
Sullivan Mach. Co., 122 S. Mich. Ave., Chicago.

Ties, Steel
American Bridge Co., 30 Church St., N. Y. City

Ties, Treated Wood
Berlin Mills Co., Portland, Maine.

Tile, Cement
American Cement Tile Mfg. Co., Oliver Bldg., Pittsburgh, Penn.
Reinforced cement roofing; tile for pitched and flat roofs.





Selling a Million Dollars' Worth of Second-hand Goods

Bradley, the Subway Contractor, Using a Series of Spreads—New Developments in Disposing of Second-hand Automobiles

SOMETHING new is always happening in the merchandising of second-hand articles. This is a vast field of selling in itself. Constructive campaigns are frequently conducted. The standards of the

68 PRINTERS' INK

"Whether you are a big contractor or a small one—whether you want to spend ten dollars or ten thousand—there are items in this price-list which fit your pocketbook and appeal directly to your requirements.

"Even if you don't know just what you want, and have nothing definite in mind, *send for the price-list, anyway*, and look over the items; the stock is so enormous that merely glancing over the items will likely suggest something you can use at a price so attractive that you cannot afford to miss the opportunity.

pocket and make you want to own the equipment without delay."

Much of the copy has a strong mail-order flavor. Some of the equipment is listed and described in the advertisements. This is done not so much to bring orders through the mails as to give the reader a taste of the catalogue and to whet his appetite to the extent that he will send for the real thing. But, then, too, the copy does bring mail-orders. In one of the spreads a photograph of two pages of the price-list was shown. Readers evidently took the trouble of deciphering the microscopic type that appeared in the picture, because checks were sent for many of the articles listed there. A large, roomy, signature-inviting coupon is run in most of the "ads." William Bradley's picture is played up in some of the advertisements. His picture appears, and part of the copy is written in the first person. An extensive set of photographs of the equipment, both as it appeared in action and as it now looks in storage, were taken, and are used effectively in the advertising.

These double-page spreads have now been running for several weeks and have already sold a

Big Bargains For Everybody
"I Have One Million Dollars' Worth of Contractors' Equipment to Sell," Says William Bradley,
Get the Price List
Bradley Contracting Company

ONE OF THE SPREADS IN A TECHNICAL PAPER THAT BROUGHT RESULTS

See page 37 of this week's Engineering News for partial list of equipment.

Do You Recognize It?

The pages reproduced are from Printer's Ink; the official organ of the advertising fraternity and the livest advertising publication in existence.

As a reader of *Engineering News* of course, you are familiar with the advertising being run by the Bradley Contracting Company to dispose of one million dollars' worth of equipment used in building the New York City Subways. The campaign was so unusual, and the selling proposition so big, that it attracted general attention in advertising circles; hence the article about it in Printers' Ink, appearing only a few weeks ago.

But the **appeal** is to **you.** You're the man this Bradley advertising is being aimed at. You're the one who can profit by it.

Send for the Complete Stock and Price List. You'll be interested in getting the full story. Write for the facts.

Bradley Contracting Co.

One Madison Avenue
New York City

Timber (Treated)
Berlin Mills Co., Portland, Maine.
Eppinger & Russell Co., 165 Broadway, New York.

Tools, Pneum
Chicago Pneumatic Tool Co., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

Tracing Cloth
National Tracing Cloth Co., Saylesville, R. I.
Robbins, Chas. H., 125 S. 11th St., Philadelphia.

Tramways
American Steel & Wire Co., Chicago, Ill.

Tramways and Cableways
Waterbury Co., The, 63 Park Row, New York.

Transformers
General Electric Co., Schenectady, N. Y.

Transmission Towers, Galvanized
American Bridge Co., 30 Church St., New York.
Blaw Steel Construction Co., Pittsburgh, Penn.

Treads, Safety
Concrete Steel Co., New York City.

Trench Braces
Bottomley Mach. Co., Alliance, Ohio.

Trenching Machinery
Austin Drainage Excavator Co., F. C., Railway Exchange Bldg., Chicago, Ill.
Ball Engine Co., Erie, Penn.
Carson Trench Mach. Co., Boston, Mass.
Erie Steam Shovel Co., Erie, Penn.
Marion Steam Shovel Co., Marion, Ohio.
Municipal Engineering & Contracting Co., Chicago, Ill.
Parsons Co., Newton, Ia. 50 Church St., N. Y. C.
Pawling & Harnischfeger Co., Milwaukee, Wis.

Trolleys (I-Beam)
Brown Hoisting Machinery Co., Cleveland, Ohio.

Turbines, Steam
De Laval Steam Turbine Co., Trenton, N. J.
General Electric Co., Schenectady, N. Y.
Kerr Turbine Co., Wellsville, N. Y.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.

Turbines, Water
Leffel & Co., James, Springfield, Ohio.
Pelton Water Wheel Co., San Francisco, Calif.

Turnbuckles
American Bridge Co., 30 Church St., New York.

Turntables
American Bridge Co., 30 Church St., New York.
Pennsylvania Steel Co., Steelton, Penn.
Whiting Foundry Equipment Co., Harvey, Ill.

Turpentine
Berlin Mills Co., Portland, Maine.

Underpinning
Underpinning & Foundation Co., 290 Bway., N. Y.
Smith, Hauser & MacIsaac, Inc., 18 East 41st St., New York City.

Valves, Altitude
Simplex Valve & Meter Co., Philadelphia, Penn.

Valves, Automatic Air
Simplex Valve & Meter Co., Philadelphia, Penn.

Valves, Water, Steam, Gas
Coldwell-Wilcox Co., Newburgh, N. Y.
Darling Pump & Mfg. Co., Williamsport, Penn.
Eddy Valve Co., Waterford, N. Y.
Norwood Engrg. Co., Florence, Mass.
Rensselaer Valve Co., Troy, N. Y.
Southwark Fdry. & Mach. Co., Philadelphia, Pa.
Wood & Co., R. D., Philadelphia, Penn.

Ventilating Apparatus
Ohio Blower Co., 5133 Perkins Ave., Cleveland, O.

Ventilation
Kernchen Co., McCormick Bldg., Chicago, Ill.

Wagon Loaders
Halss Mfg. Co., 142nd St. and Rider Ave., N. Y. C.

Wagons, Dump
Austin Mfg. Co., Chicago, Ill.
Austin Western Road Machy. Co., Chicago, Ill.
Western Wheeled Scraper Co., Aurora, Ill.

Water, Stage Recorders
Leupold & Voelpel, Portland, Oregon.

Waterproofing
Barrett Co., The, New York City.

Carey Co., Philip, 18 Wayne Ave., Lockland, Ohio.
Corrugated Bar Co., Buffalo, N. Y.
General Fireproofing Co., Youngstown, Ohio.
Johns-Manville Co., H. W., New York City, N. Y.
Master Builders Co., Cleveland, Ohio.
Minwax Co., Inc., 18 W. 41st St., N. Y. City.
Trus-Con Laboratories, Detroit, Mich.

Water Wheels
Pelton Water Wheel Co., San Francisco, Calif.

Welding Apparatus
General Electric Co., Schenectady, N. Y.

Welding and Welding Machines
Goldschmidt & Thermit Co., 120 Bway., N. Y. C.

Well Drillers
Phillips & Worthington, 90 West St., N. Y. City

Well Drilling Machines
American Well Works, The, Aurora, Ill.
Keystone Driller Co., Beaver Falls, Penn.

Wheelbarrows
Sterling Wheelbarrow Co., West Allis, Wis.

Winches
Brown Hoisting Machinery Co., Cleveland, Ohio.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.

Window Sash, Steel
Drouve Co., The G., Bridgeport, Conn.
Trussed Concrete Steel Co., Dept. 12, Youngstown, Ohio.
Representatives in principal cities.
"United" steel sash; horizontally and vertically pivoted sash. Counterbalanced and counterweighted sliding sash. Center pivoted and top hung continuous sash. Steel and glass partitions, sliding and swing doors. Casement sash.

Wire, Bare
Roebling's Sons Co., John A., Trenton, N. J.

Wire Clips
Marion Malleable Iron Works, Marion, Ind.

Wire and Cables (Insulated)
Roebling's Sons Co., John A., Trenton, N. J.

Wire Glass
Mississippi Wire Glass Co., 218 Fifth Ave., New York City.
Wire glass for fireproof constructions. Clear, frosted, patterned and special light transmitting. Sample, report on light diffusion and general catalog on request.

Wire, Special Shape
Roebling's Sons Co., John A., Trenton, N. J.

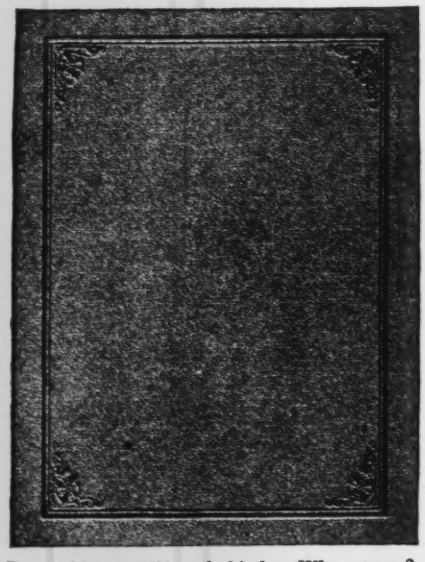
Wire, Telephone and Telegraph
Roebling's Sons Co., John A., Trenton, N. J.

Wood Pipe
Michigan Pipe Co., The, Bay City, Mich.

Wood Preserving
Barber Asphalt Paving Co., Maurer, N. J.
Barrett Co., The, New York City.
Carbolineum Wood Preserving Co., 181 Franklin St., New York City, N. Y.
International Creosoting & Construction Co., Galveston, Tex.
Northeastern Co., The, Boston, Mass.

Wrenches
Greene, Tweed & Co., 108 Duane St., N. Y. City
"Reversible socket wrenches."

"BUY THE BINDER"



Bye and bye you'll buy the binder. Why not now?

THIS is the BEST way to keep your copies of Engineering News.

¶ It's never too late to start keeping your copies of the **News** where you can refer to them quickly for ready reference. Start now by sending for the binder. Because when you want to know what that article said, what those figures were or what transpired then, you'll have the information in

Neat—Compact—Findable

form. You wouldn't say that it isn't worth 50 cents to you, would you? That is the price, prepaid to your door. Send your order now.

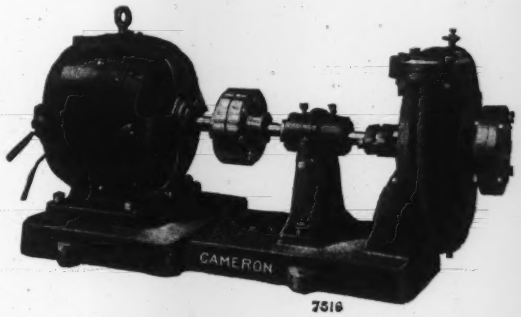
¶ A handsome, heavy board and cloth binder, heavily grained. Holds 6 months' issues. Easily manipulated and with the index, furnishes a bound volume ready for instant reference. Index furnished every 6 months **Free.**

ENGINEERING NEWS, 10th AVE. at 36th ST., NEW YORK

The Slogan of the Cameron—"Character: The Grandest Thing."

An Economical Low Head Pump
Cameron Centrifugal

Contractors have found that the sure way to secure pumping economy for low head service is with this "CAMERON" Centrifugal shown below.
It has been designed and built with the special aim to produce a combination of high working value and low operating cost.



7516

Every element in this pump is given the most careful attention during manufacture. There is no skimping of small details. Every part has strength beyond the utmost load that can fall upon it.

It is the **Cameron Single Suction Open Impeller** type which is especially designed for low head service. It is very simple, strong and rugged all through. It may be driven by electric motor, or other motive power.

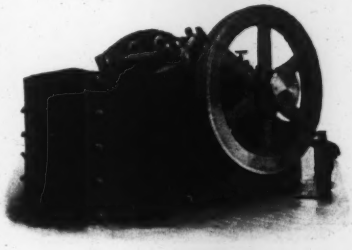
Bulletin No. 152 gives the details. Shall we send it?

A. S. CAMERON STEAM PUMP WORKS

11 Broadway, NEW YORK 629 *Offices the World Over*

McCully and Superior Crushers are chosen for big, important plants because—

SUPERIOR Jaw Crusher



Made in Sizes 36" x 24" to 84" x 66" Receiving Openings

Salient Features

Main shaft supported at the only logical point; that of no gyration.

Hopper may be built into working floor, as it is not disturbed when changing head or resetting concaves.

Positive protection of eccentric from grit and dust. Cannot wear to a loose fit.

Flanged wearing plates.

Self-tightening head.

Removable countershaft bearing.

Bushed bottom plate.

Steel gears.

Automatic Lubrication.

Tangible Facts

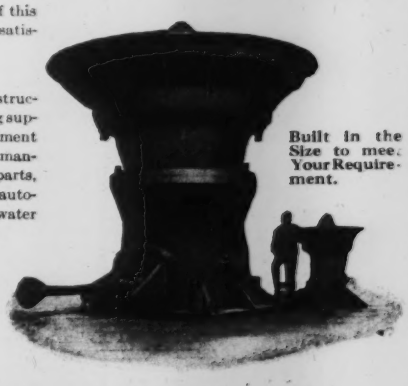
An enviable record during five years on trap rock.

A dozen machines of this type giving eminent satisfaction.

The cast-steel construction throughout, spring supported pitman, adjustment for changing product, manganese steel wearing parts, engine type flywheels, automatic lubrication, water cooled main bearings.

Leaders in the development of Large Crushers, Rolls, Screens, Elevators and Tube Mills.

McCULLY Gyratory Crusher



Built in the Size to meet Your Requirement.

Write for Catalog PM 4-19

WORTHINGTON PUMP AND MACHINERY CORPORATION

Successor to Power & Mining Machinery Company

New York Office: 115 Broadway **Works: Cudahy, Wis.**

District Offices: **Chicago, El Paso, San Francisco**
W. E. Austin Machinery Co., Atlanta, Ga.

M340-4

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National Tank & Pipe Co.	48
National Tube Co.	48
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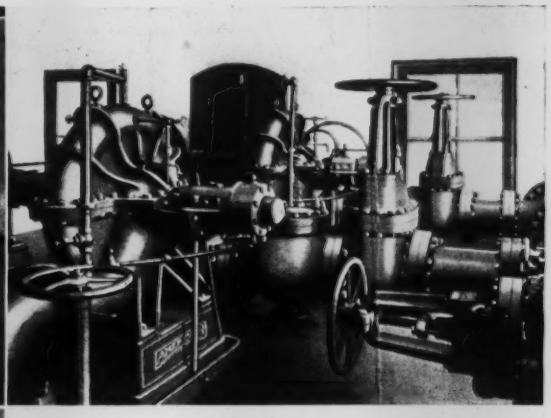

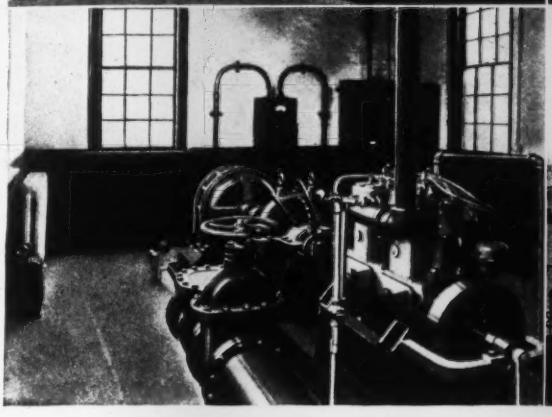

The Highest Head Single-Stage Centrifugal Water Works Pumps in the United States

The City of Lynchburg, Va., is built on several hills bordering the James River and receives its regular water supply through a 22-mile pipe line from a watershed of 40 square miles and an impounding reservoir in the mountains.

The pipe line delivers water to two reservoirs within the city limits, one of 4,000,000 gallons capacity with an elevation of flow of 320 feet above the river, the other of 3,500,000 gallons capacity at an elevation of 220 feet above the river.

In the center of the upper reservoir is a stand pipe with its top 40 feet above the surface of the water for supplying water to the highest part of the city. Water is discharged at the top of the standpipe through a pipe connecting with the main supply line, from where it passes down within the shell and flows over stonework into the reservoir. A pipe line connects the upper and lower reservoirs, and the upper reservoir therefore acts as a reducing valve, so that there is not excessive pressure on mains in the lowest part of the city fed from the lower reservoir.

To provide an auxiliary pumping plant in case the pipe line from the mountains should break, the City of Lynchburg recently installed three "American" centrifugal pumps. These are located in two stations, one containing an 8-inch unit at the upper reservoir for boosting water from the reservoir to the top of the standpipe, the other containing two 10-inch high head units located on the river bank for pumping from the river to the top of the standpipe in the upper reservoir.

Interior views of pumping stations and a view of the upper reservoir are shown in accompanying illustrations.

For the low head unit we furnished an "American" 8-inch, single-stage, double-suction, bronze-fitted centrifugal pump mounted midway between a 50-hp. General Electric squirrel cage, 900-r.p.m. synchronous speed, 3-phase, 60-cycle, 220-volt motor and a 4-cylinder, 5½x6-in. Van Blerck gasoline engine connected by Francke couplings. Pump is left connected with motor and disconnected with engine so that motor can operate pump without injury to engine. When electric current is not available, by connecting engine, pump and dead rotor of motor are operated. Pump was designed to deliver 2,100 g.p.m. against a total head of 60 feet when operating at 865 r.p.m., and we guaranteed a mechanical efficiency of 75%. The official test showed that this unit maintained an efficiency of 79%.

For the high head units we furnished two duplicate pumps. These are designed to operate singly or in parallel and discharge through an 18-inch pipe line a mile long leading from river station to top of standpipe. Pumps are "American" 10-inch, type DTMD, single-stage, double-suction, bronze fitted, diffuser centrifugals, direct-connected by Francke couplings to 300 hp., 1,800-r.p.m., synchronous speed, slip ring, 3-phase, 60-cycle, 440-volt General Electric motors. Each of these pumps was designed to deliver 2,100 g.p.m., against a total head of 412 feet when operated at 1,765 r.p.m., and we guaranteed an efficiency of 78%.

Due to the fact that pumps would operate singly most of the time, the point of maximum efficiency was moved over somewhat, and the most efficient point is on a delivery of 2,500 g.p.m., or a delivery of 2,200 g.p.m. for each pump when operating in parallel. The official test showed that these pumps maintained an efficiency of 79½% when operating singly, and 78% when operating in parallel.

At the time installation was made competitors said that single stage pumps would not do the work, but we proved that the cost was less than two or three-stage pumps of other types to do the same work, and our guaranteed efficiency was four points higher than our nearest competitor. The acceptance test showed that these pumps exceeded our guarantee.

Catalog 124 describes over 50 styles of "American" centrifugal pumps. Write for it.

The American Well Works

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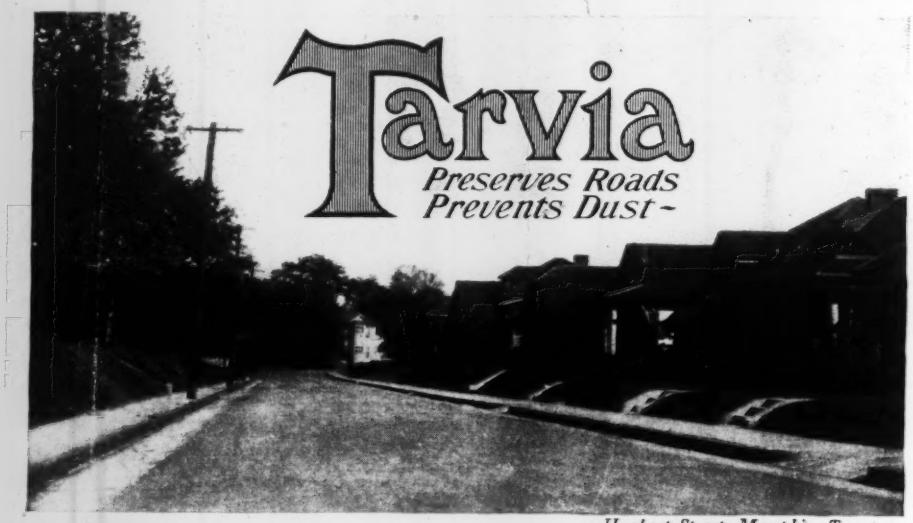

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Like many other towns Memphis uses Tarvia right along year after year as a fixed policy because tarviated macadam is the most economical roadway for modern traffic.

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We don't attempt to make one material and one process serve for all kinds and varieties of road conditions. There is a Tarvia process for most road problems.

Write our Service Department for illustrated booklet and further information.

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems.
The advice of these men may be had for the asking by anyone interested.

If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will have prompt attention.

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